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U. S. Circuit Court of Appeals

FOR THE SECOND CIRCUIT.

THE WESTINGHOUSE AIR BRAKE COMPANY,

vs.

THE NEW YORK AIR BRAKE COMPANY,
ET AL.

GEORGE WESTINGHOUSE, JR., AND
THE WESTINGHOUSE AIR BRAKE COMPANY,

vs.

THE NEW YORK AIR BRAKE COMPANY
ET AL.

Nos. 4,976
and 5,315.

No. 4,977.

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SHIPMAN, C. J.:

The various appeals in these three cases are from decrees of the Circuit Court for the Southern District of New York, upon three bills in equity for the alleged infringement of Letters Patent. No. 4,977 was founded upon Letters Patent No. 376,837, dated January 24, 1888, and Letters Patent No. 172,064, dated February 11, 1876, each issued to George Westinghouse, Jr. The Circuit Court decreed that the defendants should be enjoined against their infringement of the first, second and third claims of No. 376,837, and that the bill should be dismissed as to No. 172,064. No. 5315 was founded upon Letters Patent No. 448,827, to George Westinghouse, Jr., dated March 24, 1891. The Circuit Court decreed that the defendants should be enjoined against the infringement of the first and second claims of this patent.

No. 4976 was founded upon Letters Patent No. 393,784, dated December, 4, 1888, to Harvey S. Park, and No. 222,803, dated December 23d, 1879, to George Westinghouse, Jr. The Circuit Court dismissed the bill as to No. 393,784 and decreed that an injunction should issue against the infringement by the defendants of the second, third and fourth claims of No. 222,803. The complainants and defendants have respectively appealed from the decrees which were respectively adverse to them.

These patents are for improvements in railroad brakes by fluid pressure, and will be better understood if they are considered in the order of their relation to each other, rather than as they are grouped in the bills in equity, and therefore Nos. 376,837 and 448,

827, which was originally applied for in the application which resulted in No. 376,837, naturally take precedence.

History of the Development of the Air-Brake.

It is necessary to give the history of the development by the patentee of the automatic "quick action" air brake system, because the construction of the important claims of the two patents now under consideration and of the patent to Park, No. 393,784, depends to a great degree upon a knowledge of this history, which was accurately condensed by Judge Townsend, as follows:

The Plain Air-Brake.

"The first practical air brake is known as the 'plain brake,' and is described in Patent No. 88,929, granted to George Westinghouse, Jr., April 13, 1869.

"It consisted of a pump, operated by steam from the locomotive boiler, which compressed air into a reservoir located under the locomotive cab, which reservoir communicated by a pipe with a cock or valve in said cab, called the 'engineer's valve,' which was so located as to be readily manipulated by the engineer.

"From this valve a pipe extended back under the tender and was connected to a similar pipe under the entire length of the first car by a flexible hose. Each of the succeeding cars had a similar pipe similarly connected. This pipe was called the 'train pipe.' From the train pipe of each car a branch pipe communicated with the forward end of a cylinder called the 'brake cylinder.' This cylinder was provided with a piston, the stem of which was connected with the brake levers on the car. When the engineer wished to apply the brakes, he opened the engineer's valve, and the compressed air from the main reservoir flowed back through the train pipe and branch pipes into the brake cylinder on each car, pushing the pistons backward, causing the piston stems to operate the brake levers and force the brake shoes against the wheels.

"When he wished to release the brakes, he so shifted the valve as to shut off the flow of compressed air from the main reservoir, and to open a port or vent leading from the train pipe to the open air. "Thereupon the compressed air in the brake cylinders escaped into the open air, the pressure on the pistons was removed and the pistons were forced forward again by means of springs, thus moving the brake shoes away from the wheels.

"The validity of this patent was sustained in Westinghouse vs. Gardner & Ransom Air Brake Company (9 O. G., 538).

Objectionable Features of the Plain Brake.

"The operation of this plain brake was open to certain objections. It was too slow, and was attended by danger of collision in case one part of the train became detached from the other part.

The Automatic Air-Brake.

"The brake next to be considered is known as the 'automatic brake,' which appears to have been patented by George Westinghouse, Jr., about 1872 or 1873.

"It embodied the addition of an auxiliary reservoir and a triple-valve device to each car. Each reservoir was of sufficient capacity to operate its brakes once, thus to provide for automatic action in case of accident. The triple-valve device was located at the junction of connections between pipes leading to the train pipe, the brake cylinder and the auxiliary reservoir. In addition to these three ports, there was a fourth port leading to the open air.

Differences in the Principles Upon Which the Plain and Automatic Brakes Operate.

"The operation of this brake was radically different from that of the 'plain brake.' In the former, the compressed air was stored in the main reservoir until required for the application of brakes. In the latter, the main and auxiliary reservoirs and train pipe were always charged with compressed air at working pressure, to prevent the application of the brakes. When the engineer wished to apply the automatic brake, he shifted the engineer's valve so as to cut off the flow of compressed air from the main reservoir and open a port from the train pipe to the open air. The effect of this was to reduce the air pressure in the train pipe, and cause a back pressure from each auxiliary reservoir through the triple valve, which shifted it so as to close the port from the branch pipe to the train pipe, and stop the escape of air from the auxiliary reservoir, to close the port leading from the brake cylinder to the open air, and to open the port leading from the auxiliary reservoir, and connect it with the port leading to the brake cylinder. Thereupon the compressed air in the auxiliary reservoir flowed into the brake cylinder and applied the brakes.

"It will thus be seen that, while the former system was operated by pressure from the main reservoir, the latter was operated by withdrawal of pressure. The result was automatic action in case of accidents, whereby air was caused to escape from the train pipe, as by bursting of hose or the train breaking in two. In such cases the release of pressure operated the triple valve, and automatically applied the brakes.

Importance of the Graduation Feature in Air-Brakes.

"It is necessary here to consider 'train brake graduation' or 'service stops,' as distinguished from 'emergency stops.' While for the latter it may be necessary to admit to the brake cylinder the full pressure of compressed air, say seventy or eighty pounds, yet where it is desired merely to slow up without stopping, it may be necessary to admit only, say, ten or twenty pounds, graduating the amount of flow according to the character of service desired. It is important to bear this distinction in mind, because the appliances hereafter to be considered have been so devised as to provide therefor, and that such graduation shall be under the control of the engineer.

The Automatic Brake Could Not Be Safely Used Upon Long Trains.

"The chief objection to this automatic brake lay in the fact that it was not capable of successful operation on long trains of freight cars. The time consumed by the progressive operation of the brakes between the grip on the first and last car allowed of so much slack motion between them as to cause violent shocks.

"This automatic brake was publicly tested near Burlington, Iowa, in 1886.

The Necessity of a Reliable Brake for Freight Trains.

"The growing importance of the subject of automatic freight graduation, the inadequacy of existing systems to protect the lives of railroad employees, and the disastrous results therefrom, had become so evident that, in 1885, the Railway Master Car Builders' Association arranged for a series of experiments, known as the 'Burlington trials.'

"The Westinghouse Company and several other

companies engaged in the manufacture of brake apparatus competed at these trials.

"None of the competitors succeeded in stopping long trains of freight cars without violent and disastrous shocks.

"In 1887 the trials were renewed. There were five competing parties, including one of the leading experts for the defendants, and the complainant company. The latter then presented an improved apparatus, covered by Patent No. 360,070, granted to George Westinghouse, Jr., March 29, 1887.

Electricity Regarded in 1887 as the Only Avenue to Freight Brake Operation.

"The report of the committee of the Car Builders' Association shows that they considered 'the field for improvement open as wide as in 1886,' and concluded that air-brakes actuated by electricity were the only ones likely to be capable of successful operation on long trains of freight cars. The improved Westinghouse apparatus, while it reduced the length of time between the application of the first and last brakes, produced greater shocks than did the automatic apparatus of the preceding year.

The Freight Brake Problem Solved by Mr. Westinghouse Without Electricity.

"In this condition of affairs George Westinghouse, Jr., set himself to work to obviate these difficulties. Upon the conclusion of the 1887 trials, he renewed his investigations and experiments, and, by certain changes and improvements in the old apparatus and the introduction of new elements, he succeeded, in the latter part of the year 1887, in constructing a quick-action automatic brake, capable of being successfully applied to a train of fifty freight cars, and operative under all conditions of practical railway service.

"On October 1st, 1887, he applied for a patent for this apparatus, and on January 24th, 1888, the patent was granted. Said patent, No. 376,837, is the first of the patents in suit.

Requirements of an Acceptable Air-Brake.

"Before proceeding to consider in detail the claims of this patent, it should be stated that the following were among the requirements for the practical operation of air-brakes:

"1. The regulation of the force to be applied to the brake-shoes so as to secure all necessary graduations, from the mere slackening of speed to the service stop, and from the service stop to the emergency stop.

"2. The automatic operation of the brakes in case of accident.

"3. The practically simultaneous operation of the brakes on each car so that, in long trains of freight cars, shocks might be avoided.

"4. The control of all these operations by the engineer.

The First Successful Freight Train Brake Was the Invention of Patent No. 376,837.

"5. Certainty of operation under all conditions."

The automatic brake system constructed in general accordance with the invention described in No. 376,837 complies with all these essential conditions. It was unquestionably the first system which practically solved the problem of immediate stoppage of a long freight train in time of danger, in connection with and supplemental to "train brake graduation," and so promptly was its success recognized that 125,000 of this kind of brakes were bought and used by the railroad companies of this country within a period of little more than three years. It is, therefore, im-

portant to understand the nature of the improvement which created success.

Distinctive Characteristics of the Quick-Action Air-Brake.

The promptness with which an automatic air-brake system could be made effectual, depended upon the promptness with which air pressure in the train-pipe could be reduced and the equalization of pressure could be changed. Before the series of inventions originated by the Burlington trials, this reduction had been effected in passenger trains of ordinary length by "venting" the train-pipe or opening a port from the train-pipe to the open air, which was initiated by a turn of the engineer's valve on the locomotive. Westinghouse, in his attempt to create efficient and immediate service upon each car of a long train, enlarged the venting system, so that, when the reduction of train-pipe pressure had commenced by the turn of the engineer's valve, the triple valve under each car should also vent the train-pipe of that car. Each car, therefore, contained its own venting mechanism, and, as the mechanism did its work upon its own car, it hastened the work upon the car next in the rear. Westinghouse also sought to save, and did save, power, by compelling the compressed air thus vented to pass into the brake cylinder instead of into the open air. But sudden and large reduction of pressure is only to be used in a case of emergency, and, therefore, means for such reduction must be made supplementary to the means for the ordinary service of the brakes, so that ordinary and extraordinary use of the brakes can each be made available, as necessity arises.

The Invention of Patent 360,070 Defined.

The method in No. 360,070 was to make the ordinary range of motion of the triple-valve piston, which was produced by a reduction of train-pipe pressure of a few pounds, do the ordinary work of "braking" a train, and to make an extraordinary range of motion throughout the entire length of its capacity for travel, which was produced by a reduction of fifteen or twenty pounds, do the extraordinary work which gave to the brake the name of "quick-action." When the piston of the triple valve moved through the entire length which it could travel, the stem of the piston came in contact with the stem of the emergency valve, opened it, which uncovered a port, and thereby the train-pipe pressure was vented into the brake cylinder. The claims of the patent call the first or ordinary range of motion of the piston "a preliminary traverse," which admits air from the auxiliary reservoir to the brake cylinder, and the second range of motion "a further traverse," which enables the piston to admit air directly from the main pipe to the brake cylinder.

Defendant's Expert Testifies to the Pioneer Character of the Invention of 376,837.

This invention, palpably and confessedly, lacked success in the Burlington trials. The reason of its failure and its remedy in No. 376,837 are described by Mr. Massey, a competent expert for the defendants and the patentee of the infringing valve, whose testimony upon this subject is admitted to be correct. He said, upon direct examination, in reply to the question: "What is the practical objection, if any, to the quick-action triple valve of 360,070, and how is that remedied by the apparatus of 376,837? Before answering, state what is meant by the 'Westinghouse Quick-Action Automatic Brake.'"

"Ans. The term 'Westinghouse Quick-Action Automatic Brake,' as used by Mr. Stone, undoubtedly refers to the quick-action triple valve described in Patent 376,837, and illustrated on sheet 2 of that patent. It is also the quick-action triple valve which is illustrated in the Westinghouse catalogue of 1890.

"In the quick-action triple valve described in 360,070, in addition to the triple valve, the stem of the piston

came in contact with an emergency valve, and the extreme motion of the triple valve piston caused the emergency valve to open a small passage between the train pipe and the brake cylinder, thus causing a local exhaust of the air from the train pipe, and, therefore, reducing the pressure in the train pipe quicker than would be done by the vent through the engineer's valve. The port which was opened by the emergency valve was necessarily restricted in size, as, in order to be effective, the piston of the triple valve must be able to open it within a moderate reduction of train-pipe pressure, and, therefore, with but little force in addition to that consumed by the piston in moving the ordinary triple valve mechanism. If the emergency valve had been arranged to open a very large port, the time required to exhaust the train pipe through the engineer's valve, sufficiently to allow the piston to open the emergency valve, would be materially increased.

"This defect in the emergency valve of 360,070 would not be serious in trains of moderate length, as under, say, twenty-five cars; but in the 50-car train used at Burlington, in May, 1887, the effect was disastrous. This defect is remedied in 376,837, by using a supplemental piston to open the emergency valve and actuating that piston by fluid pressure from the reservoir through a passage controlled by a valve which is actuated by the triple valve piston. In this case the triple valve piston has only to open a comparatively small port, in addition to its regular function, and fluid pressure in the auxiliary reservoir then causes the supplemental piston to open the emergency valve."

"The length of time required, in the use of the single valve of Patent No. 360,070, to open a sufficiently large port, above referred to, appears to have been in the mind of Westinghouse in providing a separate piston of the patent in suit to open the emergency valve; for, in the description of this improved invention, it will be remembered, he states that "its object is to facilitate the application of brakes with great rapidity and full or approximately full force, as, from time to time required, by the provision of means whereby the admission of air from the brake pipe to the brake cylinders may be effected as directly as practicable, and through passages of as large capacity as may be desired."

The Important Elements of the Invention of 376,837 Defined.

No. 376,837 abandoned reliance upon the piston of the triple valve as the means of opening the emergency valve, and used a supplementary piston contained in a supplementary chamber and actuated by pressure from the auxiliary reservoir. The port, through which, when uncovered, this pressure passes, is, in the mechanism shown in the specification, uncovered by the excess stroke of the triple valve piston. The description of the mechanism, which is contained in the next paragraph, is in the language of the opinion in the Circuit Court, and, inasmuch as the intricate mechanisms of the various devices which are the subject of discussion in the three cases, now grouped together, were accurately described by Judge Townsend, his language will be used, instead of attempting to formulate independent descriptions of the same series of devices: "This emergency action is secured in the patent in suit by means of a separate supplemental piston and valve in a supplemental valve chamber below the main slide valve of the triple valve device. This chamber connects the train pipe with the brake cylinder, communication between them being regulated by the supplemental valve, opening outwardly or downwards, and a check valve opening inwardly or upwards. These valves are held upon the seats, under ordinary conditions, by a spring bearing upon their stems. In the bushing which forms the valve face of the main slide valve are four

ports governed by said slide valve. One of these ports leads to the brake cylinder, two lead to the supplemental—valve chamber on the upper or inner side of the supplemental piston, and one leads to an exhaust port.

"When an emergency stop is to be made, the engineer throws his engineer's valve wide open, thereby causing a sudden and material reduction of pressure. The excess of auxiliary reservoir pressure then forces the main piston stem against said other stem, overcoming the tension of its spring, drives the main piston to the extreme limit of its stroke, and thereby uncovers the ports leading from the auxiliary reservoir to the supplemental valve chamber. This pressure drives the supplemental piston outwardly, or downwards, against the stem of the supplemental valve, and forces it from its seat.

"Thereupon the preponderance of train pipe pressure in the brake pipe opens the check valve, and the air from the train pipe rushes directly from the brake pipe to the brake cylinder.

"The result of this operation is two-fold. It hastens the application of the brakes on the car on which it is operated, and, by venting the train pipe, it hastens a similar reduction of pressure and consequent similar operation in the next succeeding triple valve device on the next car.

"The release of the brakes is accomplished by the admission of air from the main reservoir."

The Claims of Patent 376,837 Infringed by the Defendant.

The three claims which were found to have been infringed are as follows:

"I. In a brake mechanism, the combination of a chamber or casing, having direct connections to a brake cylinder and to a brake pipe, respectively, a valve controlling communication between said connections, and a piston or diaphragm which is independent of, and unconnected with, a triple valve piston, and is actuated by pressure from an auxiliary reservoir in direction to impart opening movement to said valve, substantially as set forth.

"II. The second claim includes 'a check or non-return valve controlling communication between said valve and the brake pipe passage of the chamber, substantially as set forth.'

"III. In a brake mechanism, the combination, with a triple valve, of a supplemental chamber or casing having passages leading to a brake cylinder and to a brake pipe, respectively, a supplemental valve controlling communication between said passages, a supplemental piston operating independently of the triple valve piston, and adapted to impart opening movement to said supplemental valve, and a passage establishing communication between said supplemental piston and an auxiliary reservoir, substantially as set forth."

Defendant's Attempted Limitation of the Invention in Patent 376,837.

The vital parts of this mechanism are the supplemental chamber, having direct connections to the brake cylinder and the brake pipe, the valve 41, which controls communication between these connections, the emergency piston 63, independent and unconnected with the triple valve piston and actuated by pressure from the auxiliary reservoir in a direction to impart opening movement to the valve. To these essential parts, the defendant would add another, the particular means by which, in the specification, the emergency piston is actuated, viz.: the excess stroke of the triple valve piston which uncovers the port 61, through which the auxiliary—reservoir pressure passes. Upon the scope of the invention, the question of infringement depends. The defendant insists that the only invention "resides in the use of an emergency

piston, which is open to the exhaust port on one side and to the brake cylinder on the other side, and which is not subject to operative pressure from the reservoir, except by the extreme stroke of the triple valve piston." The assignments of error are confined to this question, and the consequent construction of the first three claims, and to the question of infringement.

Defendant's Theory Founded Upon a Misconception of the Invention.

The defendant's theory mistakes the character and scope of the invention, which was another and successful way to accomplish the work designed to be accomplished by No. 360,070, and to be effected, upon the same general plan of instantaneous brake-pipe venting, by the new means contained in the supplemental chamber which have been named.

The Invention in Patent 376,837 is Radically New and Pioneer, and the Claims Must be Given the Broadest Construction.

In No. 360,070, the stem of the triple valve piston directly engaged with the stem of the emergency valve, and consequently its action directly depended upon the movement of the piston. The invention in 376,837 radically departed from this method of actuating the emergency devices, by making a new piston, independent of and unconnected with the triple valve piston. It was to be actuated by auxiliary reservoir pressures, but the particular means by which this pressure was to be permitted to exert itself, whether continuously or only when a port should be opened, do not constitute an essential part of the invention. Means must necessarily be shown in the specification, but the identical means or the special devices were not, in the language of *Morley Machine Company, v. Lancaster*, 129 U. S., 263, "necessary constituents" of the invention, either in the specification or in the claim. The skill and mechanical ingenuity of constructors of locomotives, can, as will be seen hereafter in the examination of other patents and of the infringing devices, arrange different details of mechanical construction, by means of pistons, valves, ports and springs, which, adopting the supplemental chamber system first conceived and embodied by the patentee, and a kindred, but not precisely the same, mechanical method for the movement of the piston, will accomplish the same result. The patentee was a pioneer in that he designed, in No. 376,837, a new way to accomplish a desired result, but upon the same general idea which he had unsuccessfully tried to work out in the earlier patent. His later patent was the bridge, and not a mere step, which carried railroad-car builders from failure to success. It is not important now to determine the grade of its pioneering and whether it may be classed in the list of those inventions which are of the highest rank, but it was an invention created to achieve great necessities and overcome great hinderances, and was one of wide breadth. A court would not be justified in adopting "a narrow or astute construction" which should minimize the character of the invention, leave its real scope open to trespassers, and thus "be fatal to the grant." The claims of the patent do not contract the grant to narrower limits than those which the invention, as made by the patentee, actually covered, and the claims, therefore, are not limited to the precise mechanical means described in the specification, by which the supplementary piston is actuated. They compel it to be disconnected with and to be independent of a triple valve piston, and to be actuated by pressure from an auxiliary reservoir by some means equivalent to the means which are described in the specification. The rule, which permits and indeed compels courts to give a wide range to the equivalents which a broad or pioneer patent can include, is thus expressed in *Miller v. Eagle Manufacturing Company*,

151 U. S., 186: "If the invention is broad or primary in its character the range of equivalents will be correspondingly broad, under the liberal construction which the courts give to such inventions."

Description of Defendant's Quick-Action Triple Valves.

The defendant uses two forms of devices, known respectively in the case as "Defendant's Quick Action Triple Valve" and "Defendant's Modified Quick Action Triple Valve." Each has the supplementary chamber with its contents, and in each the various elements conform to the general phraseology of the claims, but in neither does the movement of an emergency piston have any relation to the extreme movement of the triple valve piston, and herein is contained what is claimed to be the essential difference between the patented device and the defendant's valve. In the Defendant's "Modified Valve" the pressure upon opposite sides of the emergency piston, numbered 13, which corresponds in function with emergency piston 63 of the patent, is always counter balanced when quick action is not desired, whereas emergency piston 63 of the Westinghouse valve is not subjected to auxiliary pressure until its action is required, when port 61 is uncovered.

The Characteristic Features of Defendant's "Modified Triple Valve" Are Not of Patentable Importance.

In the Defendant's Modified Valve, train-pipe pressure is reduced when quick action is wanted, the auxiliary reservoir pressure becomes controlling, forces down emergency valve 20, which corresponds in function with the Westinghouse emergency valve 41, and which, when unseated, opens direct communication between the train pipe and the brake cylinder. This difference between the means which are used to actuate the pistons is not of a patentable importance. The operative features of the invention which are described in the three claims are the same, whether auxiliary pressure is permitted to exert itself continuously or intermittently when a port is opened.

Characteristic Feature of Defendant's First Triple Valve Defined.

The defendant's earlier device uses two pistons, the first, No. 13, is forced down by auxiliary reservoir pressure, but does not act directly upon the emergency valve. When forced down "it opens a port, whereby train pressure is admitted to the upper side of the other piston (No. 17), which, being thereby forced down, imparts opening movement to an emergency valve leading to the brake cylinder."

The Testimony of the Defendant's Expert Establishes the Trifling Character of their Attempted Evasion.

It is true that piston 13, which is the one actuated by auxiliary reservoir pressure, does not directly and of itself impart opening movement to the emergency valve, but uncovers a port which admits train pipe pressure to the brake cylinder, and it is true that piston No. 17 is actuated by the train pipe pressure thus admitted. These two pistons do the work of the one piston of the defendant's modified valve. Auxiliary reservoir pressure moves the piston which, through the intervention of piston 17, imparts opening movement to the emergency valve. Mr. Masse states the difference between the two valves of the defendant to be that, in the "Quick Action Triple Valve," the initially operating piston 13 actuates the emergency valve indirectly; that is to say, through the intermediation of the piston 17; while, in the other valve, the initially operating piston 13 actuates the emergency valve directly, as in Patent 376,837."

Both of the Defendant's Triple Valves Infringe the Broad Claims of Patent 376,837.

This is not a material difference of a patentable character when considered with reference to this patent, and the result is that each of the defendant's valves in an infringement. The "quick action valve" infringes the first three claims, while the second form, not having the additional check valve of the second claim, infringes the first and third claims.

Patent 448,827 Resulted from a Division of 376,837.

No. 448,827 will next be considered. The form of automatic air brake apparatus shown in this patent was originally included in the application for No. 376,837, which also included the form which has been already described, in which port 61 was uncovered by the excess stroke of the triple valve piston. But the applicant was precluded, by a rule of the patent office, from adding to his generic claims a specific claim for the form which is now described in No. 448,827, and therefore a subordinate patent was applied for.

Description of the Device of Patent 448,827

The details of the device are described by Judge Townsend, as follows:

"The alleged invention consists of a valve, controlling communication between a supply passage from the train pipe and a delivery passage to the open air or a brake cylinder. This valve is held in position by a spring, so as to close ports leading to the delivery passage, and not to be moved from its seat by ordinary reductions of pressure for service stops. There is also a diaphragm and valve stem, interposed between the supply passage and a passage to a special reservoir or an auxiliary reservoir. Said controlling valve is connected to said valve stem. Train-pipe pressure passes through a small passage in said diaphragm into said reservoir, thus equalizing pressure on the opposite sides of said diaphragm.

"Upon a sudden reduction of pressure, sufficient for an emergency stop, the excess pressure on one side of said diaphragm moves it and its valve stem and the said controlling valve downwardly, so as to open said ports, and allow the compressed air to pass through the delivery passage to the open air or brake cylinder."

The Broad Claims of Patent 448,827.

The two claims of the patent which are said to have been infringed by the defendant's two valves, which have been before described, are as follows:

"1. In a fluid-pressure brake apparatus, normally operated by a triple-valve device, the combination with such an apparatus of a valvular appliance having a casing, provided with supply and discharge passages or connections, and a valve, controlling an exhaust port from the supply passage to the discharge passage, for quickly releasing pressure in the supply passage, said valve being actuated to open the exhaust port by a greater than normal reduction of pressure in the supply passage, independently of the action of the triple-valve device, substantially as set forth.

"2. The combination, with a triple-valve mechanism of a discharge valve controlling an exhaust port from a supply passage to a discharge passage for quickly releasing the pressure in the supply passage, said valve being actuated to open the exhaust port by fluid pressure in an auxiliary reservoir on reduction of pressure in the supply passage below the normal degree, in whatever position the slide valve of the triple-valve mechanism may be brought by such reduction, substantially as set forth."

Infringement of these claims is admitted, and the only question is in regard to their validity.

The distinctive feature of the alleged invention is that the emergency valve is actuated to open the ex-

haust port "independently of the action of the triple-valve device."

The Complainant's Theory Regarding the Invention of Patent 448,827.

The theory of the complainants is that, whereas the leading characteristic of novelty in patent No. 376,837 is the "utilization of auxiliary reservoir pressure operating a supplemental piston in proper direction to impart opening movement to the emergency valve," the invention of No. 448,827 was the means of imparting movement to the valve by "auxiliary pressure, so applied that the action or non-action of the triple valve piston shall be eliminated as an element of control," and that its distinctive feature was "the removal from the apparatus to all obstructive mechanical connection between the triple piston and emergency valve, whereby the latter may be impeded in its movements by the former."

The Theory of the Complainant Ignores the Control of a Separate Emergency Piston by the Claims of 376,837.

This theory omits an important characteristic of the novelty of No. 376,837, which is the independency and disconnection of the supplemental piston from the triple valve piston. In the form left in the application for the patent, after the divisional application was made, there was no mechanical connection between the two pistons, but the stroke of the triple valve piston exercised a control over the movement of the supplemental piston, by uncovering the port which admitted auxiliary reservoir pressure. The form in 448,827 permits, as do the defendant's valves, auxiliary reservoir pressure to be present at all times and to act upon the piston, but counter balanced during ordinary service stops. It was included in the generic claims of No. 376,837, and in view of those claims no invention could consist in the mere fact of the elimination of the action of the triple valve piston as an element of control. When the patentee obtained the broad claims of No. 376,837, he exhausted his power to obtain additional patents for mere modifications of means by which the piston should be made independent of the triple valve piston, unless the modification contained a patentable improvement upon the form disclosed in that patent. For any new and useful improvement which obtained also the element of invention, or for a separate invention, a subordinate patent could be obtained.

Patent 376,837 Fully Covers the Invention of 448,827, and the Broad Claims of the Latter Are Therefore Void.

Were the changes made in 448,827, after the idea of 376,837 had been embodied in its original form, the work of invention? So far as the first two claims are concerned, the changes consisted in a port from the auxiliary reservoir to one side of the emergency piston, which port was always open, and the counterbalance to reservoir pressure by a spring on the opposite side of the piston so that ordinary variations of pressure would not destroy the equilibrium necessary to be maintained until excessive reduction of pressure should take place. In view of the various forms and modifications and improvements of automatic brakes and brake mechanism, which had been made known before the date of this invention and which are a part of the record in these three cases, there was no patentable invention in this modified form, apart from the invention shown in No. 376,837. It was simply what the patentee first deemed it to be, a form of the invention of that patent and covered by it. The first two claims of No. 448,827 contain no patentable improvement upon the form specifically described in the claims of its predecessor and are void.

We omit any description of the other grounds upon which the invalidity of these claims is placed by the defendant.

The Park Patent, No. 393,784 is Also Subordinate to 376,837.

No. 393,784. This patent is subordinate to 376,837. The device which it describes has the supplemental chamber with the emergency piston and valve, and the important elements of the Westinghouse patent, except that the emergency valve is moved by train-pipe pressure, instead of by auxiliary reservoir pressure.

"This result was accomplished by providing a separate emergency piston and valve, ordinarily exposed to train-pipe pressure above said piston, which pressure served to hold the valve on its seat, and was not affected by ordinary reductions of pressure for service stops. But the considerable reduction of pressure necessary for an emergency stop caused air from the train pipe to be vented into the space below said piston, equalizing the pressure on both sides, and acting on the under side of said valve, causing it to be unseated and to thus allow the train-pipe pressure to be vented directly into the brake-pipe cylinder."

Claims of the Park Patent Alleged to be Infringed.

The claims said to be infringed are as follows:

"1. In a brake mechanism, the combination of a valve controlling the direct passage of pressure from a train-pipe to a brake cylinder, a piston connected to said valve and actuated wholly by train-pipe pressure, and a valve controlling the train-pipe pressure on the piston for opening and closing the communication between train-pipe and a brake cylinder through the direct action of train-pipe pressure, substantially as specified.

"2. In a brake mechanism, the combination of a train-pipe, a brake cylinder, an interposed chamber communicating with the train-pipe and brake cylinder, a piston in said chamber, a piston stem, a valve on the piston stem controlling the passage from the interposed chamber to the brake cylinder, and a controlling valve and passages for the admission of pressure from the train-pipe to move the piston and open the valve, substantially as and for the purposes specified."

The emergency piston 13 in the defendant's "Modified Valve" is actuated wholly by reservoir pressure, and this valve is, therefore not claimed to be an infringement. The emergency piston 13, in defendant's "Quick Action Valve," is forced down by reservoir pressure, but when it is pressed down it causes train-pipe pressure to be admitted, which acts upon and presses down piston 17, whose spindle presses upon and unseats the emergency valve. Inasmuch as the valve is disconnected from piston 17, it is returned to its seat when train pipe pressure is removed from the upper side of the piston, mainly by the elastic force of a spring.

The Claims of the Park Patent Must be Literally Construed and Are Thus Not Infringed.

This patent is a subordinate one and must receive a narrow construction. It is not permissible to give to the terms of a patent of that class so wide a sweep as to include the various devices which may actuate an emergency valve in a supplemental chamber by train pipe pressure, and the range of its monopoly is a limited one. The language of each claim indicates that a connected valve and piston were to be employed, and Park's method of opening and closing the valve required that they should be mechanically connected. A mechanical connection would not be indispensable, unless there was a necessity for it, or unless a mechanical separation created a difference in the

means by which the result was accomplished, which, in view of the narrowness of the invention, was a radical difference. The Park piston holds the valve to its seat, in the normal condition of pressure. It is lifted up when the valve is lifted by train-pipe pressure, and, when extraordinary pressure is removed, it restores the valve to its seat. It does not unseat the valve. The defendant's piston does not hold the valve to its seat and does not restore it to its place. When train-pipe pressure comes upon the upper side of the piston and forces it down, it unseats the valve, and, after pressure has been removed, the spring, as it resumes its shape, returns the valve to its seat. The difference in the way in which the two pistons accomplished the general result would not be a substantial one in a primary patent. It is substantial with respect to an invention which merely substitutes train-pipe pressure for the auxiliary reservoir pressure which Westinghouse used. The Circuit Court properly held that neither claim was infringed.

Description of the Invention of Patent No. 172,064.

No. 172,064. The invention of this patent was an improvement upon the improvement patented to Mr. Westinghouse by patent No. 168,359, and was a part of the brake apparatus used before the invention of the quick-action brake. It related to the direct admission of air from the brake pipe to the brake cylinder. The defence that the defendant uses the original and not the later improvement was satisfactorily sustained. The peculiarity of the patented invention and of the device used by the defendant is shown in Judge Townsend's description, as follows:

"Patent No. 168,359 provides for a piston and slide valve, so arranged that air pressure transmitted through the train pipe shall pass on the under side of the piston, and hold it in an upward position, and thence pass through a side port in the piston-valve case, and certain other ports and passages, into the auxiliary reservoir.

"The effect of this pressure is to hold the slide valve in position above two connected ports, one leading to the brake cylinder, the other to the open air, so that any pressure in the brake cylinder will escape to the open air, and the brakes will be off. When the pressure is reduced, in order to apply the brakes, the back pressure from the auxiliary reservoir depresses said piston so that it passes down and closes the supply ports and shifts the slide valve, so as to open the port leading to the brake cylinder and exposes it to auxiliary reservoir pressure, and so as to close the ports leading to the open air.

"In Patent No. 172,064, the inventor dispensed with said side port in the valve case and substituted therefor a port through the piston itself. The piston was so arranged, in connection with this port, that said port could be opened or closed without moving the slide valve. This was accomplished by having the stem of the piston fitted to the port in the piston, so that it would close the port when moved into it and open it when removed, and by further providing that the slide valve should be made shorter than the distance between the collars on its stem, thus insuring the necessary slack motion for closing the supply port before the slide valve begins to move.

The Claim of Patent 172,064 Alleged to be Infringed.

"Claim 3 is as follows:

"3. The slide-valve H, made shorter than the distance between its end bearings, in combination with the port *s* and stem *c*, or relatively arranged with reference to the operation of the valve H, while the port *s* is closed, substantially as set forth.

"Defendant's device, as illustrated by 'Defendant's Plain Triple Valve,' contains the slide valve, made shorter than the distance between its end bearings,

on the piston stem. It is also provided with two ports, one of which leads from the train pipe, through the piston chamber and by other passages to the auxiliary reservoir. The other port leads from the auxiliary reservoir to the brake cylinder. This port is closed by having the end of the piston stem slide on to it and cover it, like a valve upon its seat.

"There is no port through defendant's piston, and consequently, no piston stem fitted to enter such port."

The Purpose of the Improvement Patented in 172,064.

The claim is for the valve made shorter than the distance between its bearings with the specified improvements upon 168,359, viz.: the air port through the piston, which is opened and closed by the stem. The effect of this arrangement is stated in the specification, as follows:

"The port *s* will be closed before the valve H begins to move for applying the brakes, and will be kept closed until the valve H shall have been brought back to the proper position for a full release of the brakes. Consequently, the valve H can be operated as may be desired in applying and releasing the brakes and in graduating the brake pressure, without leakage or loss at the air-supply port *s*, and with such ports always closed."

Patent 172,064 is a Subordinate Patent and, as Such, Must be Narrowly Construed.

It is undoubtedly true that the two devices accomplish the same result and close the supply port before the valve begins to move, but infringement can only be found by giving a construction to the third claim, which disregards the fact that No. 172,064 substitutes the air port *s* with its plug *c* for the side port of 168,359.

The conclusion which the Circuit Court reached was the correct one.

It was stated as follows:

"Inasmuch as complainants claim a combination which contains a port through the centre of a piston, described as substituted for a side port, with which said improvement dispenses, and as defendant's device depends upon the use of a side port, and has no port through the piston, but is made up by a combination of different elements, which are admitted in Patent No. 172,064 to be a part of the prior art, the combination claimed in claim 3 of said patent is not infringed.

"A correct construction of the claim must include the port through the center of the piston, substituted for the side port of Patent No. 168,359."

Description of the Engineer's Valve of Patent 222,803.

The invention of No. 222,803 was an engineer's valve, which, speaking in very general terms, should, by the movements of a single stem or lever, admit and automatically stop admitting fluid pressure to the brake pipes, by means of a charging valve, automatically retain such pressure and permit its escape by an exhaust valve, with means for automatically closing either valve when the desired pressure had been charged into or withdrawn from the train pipe to which the device was connected.

The patentee summarized, in his specification, his invention, as follows:

"It will now be seen that I provide for operating both the supply and the exhaust valves by a single stem, that only one can be opened at once, that either may be opened separately (much or little), and that both may be closed simultaneously and automatically, and kept closed whether the brakes are on or off."

This automatic closing of the charging and exhaust valves was a very important part of the invention.

The patented valve, so far as the second, third and fourth claims are concerned, consists of piston case, containing a piston, governing a charging valve held up to its seat, partly by fluid pressure and partly by

a spring, and an escape valve held down to its seat, partly by gravity and partly by a preponderance of fluid pressure on its upper end.

This governing piston is exposed on its under side to fluid pressure, and on the upper side to pressure from a spring. A screw-stem worked by a crank arm, is so arranged in connection with said spring that, by the revolution of the crank-arm, the downward pressure of said spring upon said piston is increased or lessened.

The effect of such change of pressure is to cause the piston to be moved upwards or downwards according as it is acted upon by an excess of fluid or of spring pressure, and to open or close the charging and escape valves.

Beneath the lower end of the escape valve, provision is made for a certain amount of slack motion, so that the governing piston may be moved up or down for a short distance without unseating the escape valve. The effect of this arrangement is to prevent the possibility of both valves being open at the same time.

Operation of the Engineer's Valve of Patent 222,803.

The operation of said apparatus is as follows:

In order to apply the brakes or to open the charging valve, the crank arm is screwed down, and this increase of pressure, transmitted through the stem of the piston-head to the charging valve, unseats it and permits fluid pressure to pass from the boiler or storage reservoir to the train pipe and brake cylinders.

The fluid pressure also passes upward to the space below the piston head and exerts the same pressure upon it as in the train pipe or brake cylinders.

The engineer knows, from his engineer's gage, just how far to screw down his crank, so that, when the necessary amount of pressure has passed through to the train pipe or brake cylinder, the same pressure will automatically lift the piston and close the charging valve.

The crank arm is screwed up in order to open the escape valve, and, after the proper amount has been discharged, the escape valve automatically closes in the same way as already shown in the case of the charging valve.

The Claims of Patent 222,803 Infringed by the Defendant.

The three claims which the Circuit Court found were infringed are as follows:

"2. As a means for automatically cutting off the fluid-pressure supply when the desired pressure has been charged into the brake cylinders, a piston head P, movable by the operative brake pressure or any excess thereof, in combination with the charging valve and a connection from one to the other, substantially as set forth, whereby such movement of the piston head will result in the automatic closing of the charging valve, substantially as set forth."

"3. The combination of piston head, charging valve, interposed stem and escape valve, substantially as set forth, with reference to the opening and closing of the charging valve, without necessarily opening the escape valve, substantially as set forth."

"4. The combination of piston head, charging valve, interposed stem, escape valve and a single operating stem, adapted by independent connections with both valves to shift both by independent successive motions, substantially as set forth."

Description of the Defendant's Engineer's Valve.

The defendant's valve has a single lever which is moved from side to side by a single handle having a reciprocating motion. The valve has also a piston exposed to fluid pressure on both sides, which controls a charging and an escape valve, which perform the same functions as in the patented valve.

"The main lever, which is fastened to said handle, carries an eccentric pin, which passes through said

lever, and which moves in the arc of a circle. The right end of the lever is held stationary by a jaw and fulcrumpin; the left end, when said handle is moved to the right, is lifted by the rock-shaft motion imparted by said pin, and strikes against another pin, attached to the escape valve, and raises and opens said escape valve. This lever has also an upper jaw, which moves in a pin attached to a bell-crank lever, the arm of which is directly beneath the charging valve. In order to open this valve, the handle is moved to the left, which causes the main lever and pin to move to the left, and to raise the arm of the bell crank lever and open the charging valve. Provision is made for slack motion by a space between the top of the escape valve and said pin attached thereto, whereby the left end of the main lever is permitted to have a certain amount of play before it strikes said pin."

In addition to fluid pressure, the piston is "acted upon below by a bell-crank lever, or bent lever with vertical arms, connected by links to the piston, and to a second lever, which second lever is connected with a light spring."

Attempts of the Defendant to Anticipate the Invention of Patent No. 222,803.

An attempt was made in the testimony to claim that the patented valve lacked novelty, or that its descent could be traced from Patents No. 129,015, dated July 16, 1872, issued to Fay and Cairns, and No. 141,685, dated August 12, 1873, issued to George Westinghouse, Jr. The Fay and Cairns patent was for an apparatus for regulating the flow of water in houses and shutting it off when there is an excess of pressure, so as to prevent the bursting of pipes. The Westinghouse patent was for a triple valve and it was admitted in the course of the testimony that the patent described nothing designed for or capable of performing the function of the engineer's valve. The Fay & Cairns invention was a pressure regulator, contained no exhaust valve, and could not be an engineer's valve. The idea that either of these patents anticipated or restricted the patentable character of the whole invention is not now entertained. The defendant is, however, of opinion that No. 141,685 is an anticipation of the second claim. The importance of this suggestion will be considered hereafter.

Patent 222,803 is for an Important Pioneer Invention.

The invention, as a whole, is thus conceded to be without a predecessor, and the importance of an invention by which both valves could be automatically closed upon the desired amount of pressure being charged into or exhausted from the train pipe is manifest.

The object of the defendant's valve is by the movement of a single handle to accomplish the same results which the patented valve attains, and it is conceded that the valve has a piston head, movable by operative brake pressure or any excess thereof, a charging valve, an escape valve and interposed connections so arranged that the charging valve may be opened and closed without necessarily opening the escape valve, a connection between the piston head and charging valve, consisting of a bell-crank lever, a pin and lever and a projection on the piston head, and that by reason of this connection a movement of the piston head under the operative pressure or any excess thereof, will result in the automatic closing of the charging valve.

Contention of the Defendant.

But it is contended that the second claim of the patent is void by reason of the Fay and Cairns patent, that the defendant's valve has not the interposed stem of the third and fourth claims, because the motion of the complainant's piston always acts through the stem to open the valve, that the de-

fendant's piston does not open the charging valve as required in the third claim and does not open either valve, except only that the pin carried by its piston is the fulcrum of the lever when the escape valve is opened, whereas, neither the valves in 222,803 can be opened except by moving its piston, and therefore that the true construction of the third and fourth claims is as follows:

In regard to the third claim: "The combination of a piston for opening and closing two valves by reverse motions of the piston; those valves, and a part interposed, whereby the motion of the piston in one direction from its position with both valves closed, opens one of the valves, and its return motion allows that valve to close, while its motion in the opposite direction opens the other valve and its return motion allows that valve to close." In regard to the fourth claim: "The above combination, with the addition of a single handle by means of which the engineer can vary the pressure on one side of the piston."

The second claim of the patent contained the case provided with a piston chamber and valve chamber in addition to the three elements which are specifically named.

The Fay and Cairns patent was a water pressure regulator. The specification says that it consisted of a hollow cylinder attached to a valve and communicating at one end with the water pipe into which the water flows through the valve. In the cylinder is a piston whose rod is connected to the valve, a coiled spring is behind the piston under such tension as to hold the valve open until the pressure becomes too great for the pipe beyond the valve, when the water pressure on the piston closes the valve and keeps it closed until the pressure on the piston and in the pipes falls below the power of the spring, when it will open the valve cylinder. There is no exhaust valve, but claim 2 does not include an exhaust valve, and the valve is connected with the piston, whereas, in No. 222,803 the charging valve is closed by a separate spring, but this is thought by the defendants to be immaterial in a structure not having an exhaust valve, "the purpose of separation being to permit a further upward movement of the piston so as to open the exhaust valve after the charging valve has been seated." The needs of a water pressure regulator to be attached to a water pipe which conveys water into a house, and an engineer's valve in which there must be a charging and an escape valve are very different.

In an engineer's valve, opened by a single stem, the charging valve must be separated from the piston or the device would be useless, and it is no answer to the validity of the claim to say that some other fluid-regulating device was operated by a different arrangement of valve and piston which, though it might come within the general terms of that claim, would be useless in the device which was the subject of the patent.

The Defendant's Position Not Well Founded.

The great dissimilarity in form and appearance between the patented valve and the defendant's valve tends to confuse the mind when the question of the infringement of the third and fourth claims is first looked at. The defendant's valves and piston are not arranged in the same axial line, motion is not communicated to the piston in an endwise direction, but through a series of bell-crank levers, which at first seem to be operating upon a different system from that of the patent. A closer examination shows that the series of operations in the patented valve is substantially reproduced in the defendant's valve by like instrumentalities. It is not denied that the defendant's valve has a series of levers and pins which may be called an inter-

posed stem, and which communicate motion somehow, but it is said that its piston and its stem do not correspond with these elements in the third and fourth claims, mainly because in the Westinghouse device the motion of the piston acts through the stem to push the valve open, and the defendant's piston does nothing to open either valve.

It is true, that in the Westinghouse valve, there is a direct connection between the piston and the charging valve, and that the movement of the piston opens the valve, and that, in the defendant's valve, the charging valve is opened by the manual movement of the handle and lever, 49, and the piston, at the time, remains stationary.

By the subsequent movement of the piston, when sufficient train-pipe pressure has been admitted, the charging valve is closed automatically.

It is also said that the defendant's piston does not open the escape valve, except that the pin carried by the piston is the fulcrum of the lever when the escape valve is opened. This may also be considered as true, but it should also be said that there is an upward movement of the piston before the valve is opened.

As explained by Mr. Barnes for the complainant, the movement of the handle to the right raises the fulcrum of the lever, which imposes upward pressure upon the piston; it moves upward until the elastic resistance below the piston is reduced so much that the train-pipe pressure on top of the piston can lift the escape valve by means of the lever known as 43.

If the third and fourth claims require that one or both valves must be opened and closed by the motion of the piston, and that the interposed stem must move with the piston to open one or both valves, then there is no infringement. The third claim, for example, is for the combination of piston-head, charging valve, interposed stem, and escape valve with reference to the opening and closing of the charging valve. As the invention did not consist in the particular way in which the elements of this combination coöperated, in reference to the mere opening of the valve, and as the language of the claim is not limited to anything more narrow than the actual invention, the construction which the defendant seeks, is not necessary; the only question is whether the differences which have been stated, and which are, in substance, the difference between the direct action in the patented device of the piston, through the interposed stem, in opening the valves and the action of the bell crank lever, pin and lever, which are the interposed stem of the defendant's device, constitute such a departure from the means which the patentee used and described, as to constitute new and different means which escape a just charge of infringement.

The Claims of Patent 222,803 are Infringed by the Defendant's Engineer's Valve.

The question of infringement is controlled by the principles restated in *Morley Machine Co. vs. Lancaster*, 129 W. F., 263, and confirmed in subsequent and recent cases (*Miller vs. Eagle Mfg. Co.*, *supra*), and which makes these actual differences, which would be important in a subordinate patent, unessential when a patent for a pioneer invention is under examination. If such differences should be regarded by courts as essential, when the claims do not make the specific devices essential, patents for pioneer inventions would ordinarily have but little value.

Decision of the Circuit Court Confirmed, Except as to Patent 448,827.

All the decrees of the Circuit Court in case No. 4976, and in case No. 4977, which have been appealed from, are affirmed with costs of this court. The interlocutory decree of the Circuit Court in case No. 5315 is reversed with costs of this court, and the cause is remanded to that court with instructions to dismiss the bill with costs of that court.



FRIDAY, OCTOBER 26, 1894.

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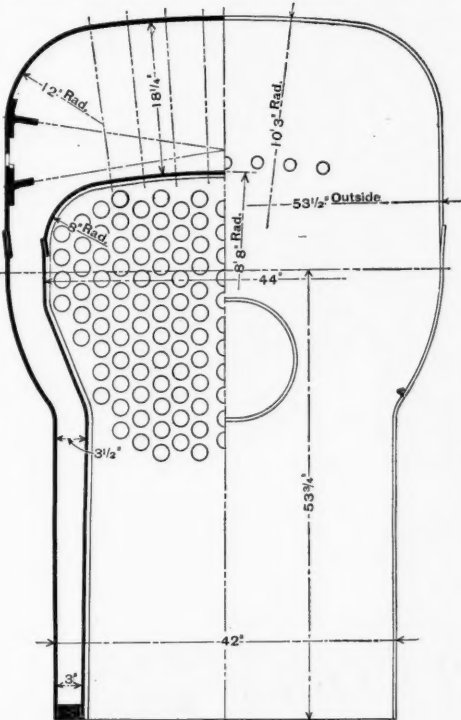
Contributions.

Belpaire Boilers.

October 26, 1894.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In your issue of the 19th inst., in describing some of the Brooks locomotives recently built for the Central Railroad of Brazil you refer to these engines as having "the improved Belpaire fire box patented by Mr. John Player, Mechanical Engineer of the Brooks Works.



Belpaire Boiler—Rogers Locomotive Works.

The top of this is arched, as is the crown sheet, and the crown stays are radial."

You may perhaps be interested in knowing that in 1881 the Rogers Locomotive Works designed and built four American type engines for the Denver & New Orleans Railroad, and two for the Boston, Hoosac Tunnel & Western Railroad, with Belpaire boilers having arched crown and shell sheets with the stays radial to both, as shown by the enclosed blue-print. As this construction appears to cover the essential features claimed by Mr. Player, it would seem as though his invention was anticipated there by a good many years. V.

White Lights for Safety Signals.

TO THE EDITOR OF THE RAILROAD GAZETTE:

There is a terminal company in this country which has two large yards, a mile or more apart. In one of these yards the switch lamps have a green light for safety. In the other, they have white. Now the passenger traffic of a number of roads is run through the "white" yard to the "green" yard, some of it by the engines of the terminal company, and some by the road engines. Just before they reach the "white" yard, and at a point where all trains must stop unless a safety signal is shown, is placed a lamp, white and red. Recently it was found that a bit of the red lens had been broken off. From the ground, or off to one side, the red showed perfectly.

From the cab of an engine the red could be looked over and the white seen. An engine driver discovered the breakage, called the attention of an official to it, and it was fixed.

But suppose that meantime another engine driver had come along; one less alert and one used only to the white lights of the yard he had left behind, and who overlooked the break in the red lens and saw only the white safety light behind it, what might have happened? Perhaps something serious. But with a green light for safety he would have stopped and the dangerous breakage would have been discovered. What more favorable conditions could a train wrecker (or robber) want, if he could turn a switch, than a white light for safety? All he would need would be a coupling pin or a stone. One blow would shatter the red or other danger lens, and then his white light would beam forth its assurance of safety. DERRICK.

The Day of Small Things.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The President of one of the largest railroads in the country once said to his General Manager in presence of the writer, that too large a proportion of time and attention was usually given by managers to the traffic side of operation. The movement of traffic, he said, was largely governed by the conditions of the markets, the weather and crop conditions, and various natural laws of supply and demand, so that the efforts of the individual manager could affect but a small proportion of the total. The successful manager, he believed, was one who turned his attention largely to getting as much as could be obtained for such traffic as was moved, rather than by endeavoring to move everything his way by inducements in rates, which might do much more damage to business legitimately belonging to the road than any gain in diverted traffic would amount to.

Above all, he said, the successful manager was the one who turned his attention largely to the systematic conduct of the operations of the road, especially in the matter of close research into and scrutiny of details involving expenses. It is upon this proposition that I wish to touch.

The average rate received per unit for carrying freight and passengers has been reduced in the past 10 years faster than the cost, notwithstanding the improvements that have been made in methods of operation. When the margin was larger, the failure of a single crop or industry was not a vital matter to any large road, but now such a failure often causes such a large percentage of loss from the already diminished net revenue that the situation immediately becomes serious, and drastic measures are necessary.

When a course of retrenchment is decided upon, the first search that should be made is to examine whether the general methods in use are best adapted to the desired result of the largest net earnings consistent with safe and efficient operation. It will be needless to dwell upon specific cases here, as the research would differ upon each road, and the experience gained in making such an examination would be most valuable. It will be found upon nearly every road, I think I can broadly state, that some of the methods of operation and forms of construction, whether in superstructure, buildings or rolling stock may have been designed more from a standpoint of department excellence than as a means to earn cold dollars. Therefore, means should be taken so that all department officers may be kept advised cheaply and promptly how the result of their labors affects the general working of the property.

Again it will be found that certain practices or methods which were allowable or advisable under former conditions, either of traffic or revenue, have been continued through sheer force of habit, but are by no means good practice under the present state of affairs. This avenue of investigation will always repay careful study.

Examination often develops the fact that in some, or it may be in all departments, attention is not given to having all employees understand to a certain extent the reason for any instructions given them. Any man, no matter how low his rank in the scale, can work more effectually if he works intelligently, and will show more economical results. Every effort should be made to root out the notion that it is unnecessary or inexpedient to give reasons for instructions.

It is also very important to know that every requisition for material, every hour's labor and every minor practice of operating is so watched that the largest result in performance for the smallest amount of expenditure can be reached. A proper organization, with capable men, of course involves this condition, but we too often find that many leaks exist even in the face of conscientious and continued effort. Means should be taken, varying on different roads in different departments, to know that every detail, whether of accounting or general office work, or in the transportation, mechanical, road or engineering departments, has been carefully examined to see that the most effective methods are in use. Such examination, if carefully made, shows on one hand, the efficiency of the department officers if a firm hand has been kept in the past upon the details of their business, or will, on the other, develop many directions in which improvements and savings will be made.

Experience has proved that when careful investigations of this character are made, the stratum of the service in which the leaks exist is much lower than might be expected. There often exist, in matters small in

themselves, but large in the aggregate, connected with every day details, in the hands of so-called practical men, the chances of material loss to the road. There are a thousand or more things relating to routine practice in the hands of individual employees, or the lower classes of foremen and officials, which are taken for granted on account of their apparent simplicity, yet in which much loss is taking place. The list of matters of this kind, which have been discovered in various places, is a formidable one, and they occur on lines where the higher department officers are using every effort to make their methods and their structures equal to anything in the country, as far as general purposes are concerned. Experience has proved that it is largely in these details, which are often overlooked, that advances toward more efficient railroading must be made. Success in railroad operation demands that, unlike the man in Pilgrim's Progress, the average manager must do a great deal of work with the muck rake of investigation, among the dust and straws of details, before he can receive the crown of large net revenues, and a well-earned dividend. Z. Y. X.

Railroad Legislation and National Prosperity.

BY DON ALEXANDER, Division Freight Agent, C. N. O. & T. P. Ry.

I.

We are just emerging, it is hoped, from a period of extreme commercial depression, and the time is opportune for the study of the causes which led to the depression, and thereby of the path to betterment and the prevention of recurrence. The depression of the last four years presents two singular distinguishing characteristics, which are apparently paradoxical.

The first is that it has created a powerful sentiment for expansion of our currency. There has never been such unanimity of sentiment, influencing so large a proportion of the nation, championed by advocates so respectable, in any of the previous movements looking to currency expansion. Side by side with this is the other distinguishing characteristic, which is that our currency now in circulation is greater per capita than ever before in our history; greater per capita than that of most of the other civilized nation to-day; and that our currency is undepreciated. Every issued dollar is worth to-day as much as any other dollar in the world's markets.

Our material development and prosperity during the last century—particularly during the last half century—is unparalleled in the history of nations. No nation has enjoyed so large an investment of capital. This investment has been mainly in our government, state, county, and municipal bonds; our railroad bonds and stocks; our land mortgages and our industrial enterprises, which have been for the most part made possible by railroad construction. Exact data are unobtainable, but we may say that considerably the greater part of the capital so invested has been foreign capital; or, in other words, our phenomenal development has been accomplished on credit—our credit with foreign capitalists. It has so happened that the largest investment of foreign capital has been in our railroad securities.

It is a matter of public and universal knowledge that the period of business depression through which we are passing was precipitated by the failure of the Barings some four years ago; that their failure was largely induced by shrinkage in values of South American railroad securities; that United States railroad securities were thereby greatly depressed; and that this failure was followed by an immediate, wholesale, and continuous return of our own railroad securities, with consequent withdrawal of foreign money. This money was not reinvested in anything else in America; it has not been returned for investment; it is simply withdrawn. Our national situation is exactly analogous to that of a merchant who has been doing a prosperous business on borrowed capital, but whose creditor becomes dissatisfied with the security held for his money and calls it in. The merchant becomes straitened; his business becomes unprofitable; and unless he possesses great business tact, and his business possesses great elasticity, and both manifest adaptability to the changed conditions, he fails. So with our national business. The great merchant, Uncle Sam, was getting along swimmingly on European money, paying four per cent, and earning eighteen per cent., and had given his creditors railroad securities as collateral. They became distrustful of the collateral, and called their money home. Uncle Sam became "hard up"—experienced "hard times." His condition was only slightly mitigated by the fact that during the period of prosperous operation on borrowed capital he had bettered his own financial condition—increased his per capita wealth. His own capital was still woefully inadequate to carry on his business on its former scale and with its former profits.

What is the course of the careful and prudent merchant who finds his business crippled because of the sudden dissatisfaction of his creditors with security on which he has been borrowing money to conduct his business? He looks at his security to find why it has become unavailable.

So distinguished an authority as Judge Veazey, one of the most useful members who have dignified the Interstate Commerce Commission, has said: "Twenty-five years ago the establishment of an iron highway through any section was still regarded as an unmixed public blessing, and he who refused to give a right-of-way

through his land, or the locality which declined to assume large indebtedness for its construction and equipment, was condemned as lacking in public spirit. The only problem of that day was how to secure more railroads. Later, when phenomenal railroad building had practically annihilated distance, had established competitive relations between localities which before were safely independent of each other, and thereby reduced the profits of traders and producers, then the railroad problem took on something of its present character, and then began that agitation of public opinion throughout the land which continued for more than a decade, grew in intensity with the abnormal construction and development of that period, and culminated in the Congressional enactment of 1887."

Judge Veazey herein very mildly points out the emphatic and radical change of public sentiment, promptly reflecting itself in State and Federal legislation, from anxious support and generous encouragement of railroad investment, to malignant hostility, oppression and confiscation. He also points out the cause of this change—the establishment by railroads of that very competition between producers and dealers which was contemplated by them as their greatest benefit.

Many of the existing American railroad securities were created, and the character of those since created was established, during the conditions of popular and legislative favor which existed prior to say 1872. The flood of hostile legislation that followed that year was not felt in its fullest effect by security holders for years thereafter. Abundant crops, newly developed traffic, economies in operation, postponement of renewals, abstention from betterments and many other devices, including in some cases devious accounting, all conspired to keep up interest and dividend payments after adverse conditions had destroyed corresponding net earnings. But this widow's curse was not inexhaustible. The end was inevitable. In the last 10 years 532 United States railroad companies, covering over 63,000 miles, and representing over \$3,300,000,000 of invested capital, have become insolvent and have passed into the operation of the courts. During the same period the average rate per ton per mile for freight transportation on seven typical railroad systems, representative of the seven geographical divisions of the United States, has decreased from 1.86 to .89. Colonel Aldace P. Walker, who has ornamented the bar, the bench, the Interstate Commerce Commission, and the railroad traffic service, and who has now been called to undertake the reconstruction and management of our most magnificent railroad wreck, has said: "It is not for the interest of any country that its investment of capital be discredited and effaced. Our railroad securities should rank in foreign markets with the securities of our government. That they do not so rank is evidenced by the hundreds of millions of such securities that have been returned to our shores during the last three years, as well as by the unfriendly criticism of the English financial press."

In these facts, the merchant, Uncle Sam, will discover why the securities on which he has previously borrowed money easily have become unavailable. The natural step for the public merchant, as for the private merchant, is to seek a remedy for the impairment of value. That remedy, when found, is the remedy for "hard times." It is the solution of the problem of expansion of the currency. It is the panacea for our commercial depression, because it strikes at the root. It is the preventive of its recurrence because the diagnosis of the disease points the way to its avoidance.

The remedy for the present depreciation of value of our railroad securities, the formula for bringing about their appreciation through a restoration of confidence in them on the part of foreign investors is a dual one.

First, public sentiment must be so enlightened as to enable it to analyze the fallacies which are so prevalent in the treatment of the railroad problem, to emancipate itself from demagoguery and to actively assist the movement which has already taken form in commercial bodies and, in less degree in legislative bodies, for the relief of railroads from burdensome and oppressive legislation. Mr. George R. Blanchard has said: "Too many of the surmises, assertions, false reasonings and conclusions of the unfair, the uneducated, the hostile, and of political clamorists have passed unchallenged. This has continued so long that many who approached with fair minds the great problems which underlie these great public averments have concluded that we lack good grounds of rejoinder, defense and proof. In this respect we are at fault. We should have not only a defensive but an aggressive railroad literature—opposing facts to fancies, soundness to sound, and reasoning to railing." Another distinguished traffic officer, Mr. E. P. Ripley, Vice-President of the Burlington system, has said: "Misstatements as to railroad motives and methods are rife in all conceivable forms, and little is heard on the other side. It has been so popular to abuse the railroads that the other side seldom gets a hearing. The railroads must have a hearing—must force a hearing—must engage public attention aggressively, and educate public sentiment. If there has ever been an impression that legislation could be obtained or thwarted against public sentiment, it is time to abandon it. The time is ripe for a reaction in public opinion favorable to the railroads. Let us develop that reaction and we can obtain any proper legislation we ask."

Second, full confidence in our securities requires that investors shall be protected against dishonesty on the part of railroad managements. That such dishonesty is common is not believed by any well-informed man; that

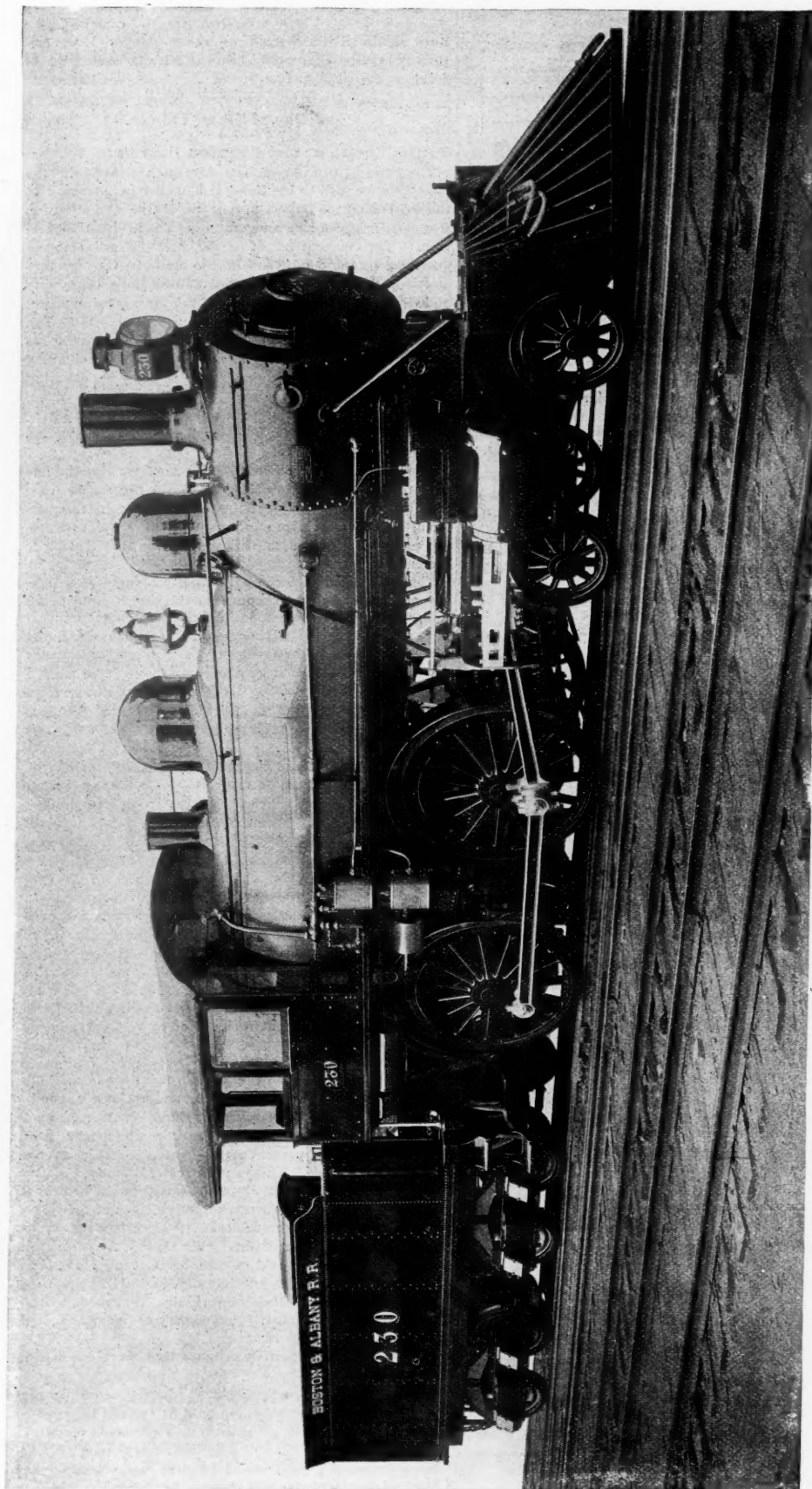
such dishonesty exists and has existed the best-informed men must admit. Reference has already been made to the efforts of railroad managements during the years of reduced net earnings that followed the hostile legislation of the early '70's, to maintain the value of their securities by methods that were not communicated to European investors. They sowed the wind and have reaped the whirlwind. Such methods have unfortunately not entirely disappeared.

This article has attained such length that it will not permit of discussion as to the methods of education of public opinion; the specific results in legislation and re-

shown here from photographs taken of the machine in operation.

The work consists in the corrugation of metal plates by milling, using gang mills, and finishing a plate at one cut. These plates are of steel $\frac{3}{4}$ in. thick, 24 in. wide and 40 in. long. The corrugations are arcs of circles of $\frac{1}{8}$ in. radius, and cover a surface 20 in. wide by 33 in. long and are milled $\frac{5}{32}$ in. deep, requiring a gang of mills 33 in. long to do the work.

Spencer Kellogg, of Buffalo, N. Y., for whom this work is being done, use about 1,000 of these plates and it has been necessary to work 24 hours a day, using double sets



EIGHT-WHEEL PASSENGER LOCOMOTIVE FOR FAST AND HEAVY SERVICE—BOSTON & ALBANY RAILROAD.
Built by the SCHENECTADY LOCOMOTIVE WORKS, Schenectady, New York.

peal of legislation to be thereby attained; and the methods of so safeguarding the operation and accounting of railroads as to protect non-residents and remote investors against fraud as to their rights. If the foregoing conclusions are right, these details are important, and should constitute a large part of that public education urged by Mr. Blanchard and Mr. Ripley.

CHATTANOOGA, Tenn., Oct. 1, 1894.

Some Remarkable Milling.

Some remarkable work in surface milling is being done by the Pratt & Whitney Co., Hartford, Conn. It is

of mills to avoid the loss of time in grinding.

The manner of making these mills is interesting. One set is made up of 30 separate pieces, each 8 in. diameter, $1\frac{1}{2}$ in. wide and 4 in. bore, the faces of each being ground so that the joint will show as little as possible on the milled surface.

In the other set there are four mills only, or four blocks, two of the blocks contain nine each of the corrugations, one eight and one seven, making the same number as the former set and being of the same dimensions otherwise. They are interlocked, forming in effect solid mill 33 in. in length, 8 in. diameter and leaving a surface absolutely smooth. The cutting edge of each row

of teeth in the blocks is set far enough back of the teeth in the preceding one so that only one block, or eight mills, is cutting at one time.

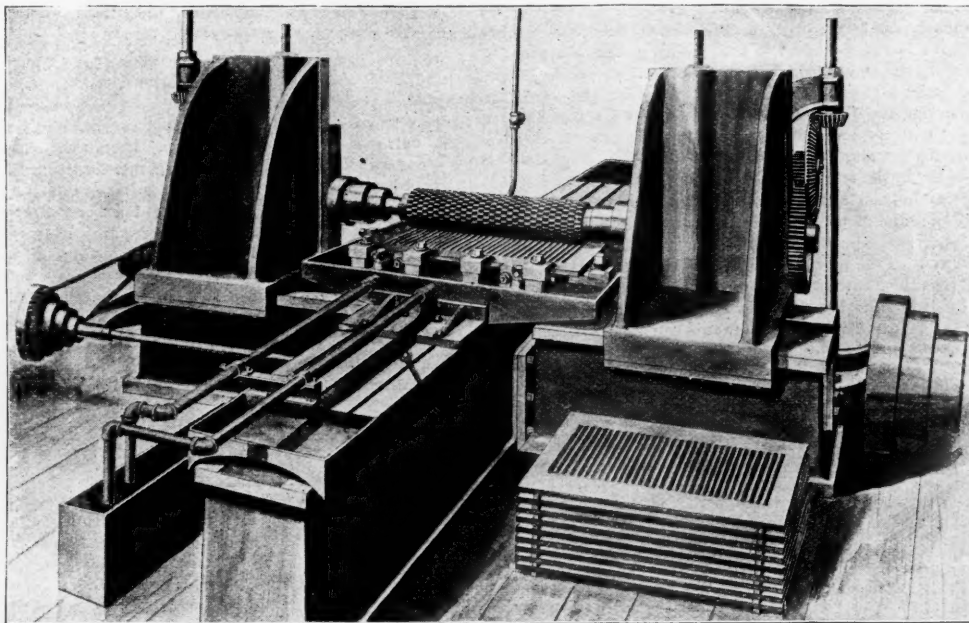
The plates are milled at the rate of about one an hour, including changing, and the mills being kept well lubricated run from six to seven days without grinding.

The machine in which these mills are operated is built by the Pratt & Whitney Co., and known as No. 7, double-head, power miller, and is probably the only machine built in this country capable of doing this work. It was designed and built to meet the requirements of work of this kind. It is built with either single or double head and provisions, are made for driving both heads together or separately as is necessary.

which will probably be built, in which not only the crank pins, but the piston rods and some other parts, are to be forged hollow. It will be observed that the heating surface is 1844.7 square feet, an unusual area for engines of this weight. The dimensions and other particulars follow, and a good notion of the appearance of the engines is given by the illustration, from a photograph.

SPECIFICATIONS, SCHWENCKTADY LOCOMOTIVE, BOSTON & ALBANY RAILROAD.

Fuel.....	Bituminous coal.
Gauge of road.....	4' 8 ¹ / ₂ "
Weight of engine in working order....	114,760 lbs.
" on drivers.....	74,000 lbs.
Wheel base, driving.....	8' 5"
" " total.....	22' 11"



Pratt & Whitney Milling Machine for Large Surfaces.

The table is driven by a large, and extra long, worm gearing with rack on under side; this worm is in halves and is adjusted for taking up wear in the threads. It has ball bearing collars on both ends for taking the thrust.

The spindle is of steel with tool-steel thrust collars, hardened and ground. The front bearings are 11 in. long and $5\frac{1}{2}$ in. diameter; greatest distance between centers 54 in.; least distance 14 in.; greatest height, center of spindle above table, 25 in.; least height 4 in. The table is 20% in. wide, and the length the limit of its travel. The speeds are so arranged as to take cutters from $4\frac{1}{2}$ to 18 in. diameter.

The present work, while not showing the same result in cubic inches of stock removed per minute as in milling side rods and like work, is probably the severest test the machine has been put to, owing to the great length between centers and amount of surface involved.

The work has been watched with great interest by mechanics visiting the company's works the past month, and astonishment expressed at the ease with which the work is done, the uniform smoothness of the milled surface and the entire freedom from any evidence of chatter which might be expected in a gang of mills of this length.

Schenectady Locomotives for the Boston & Albany.

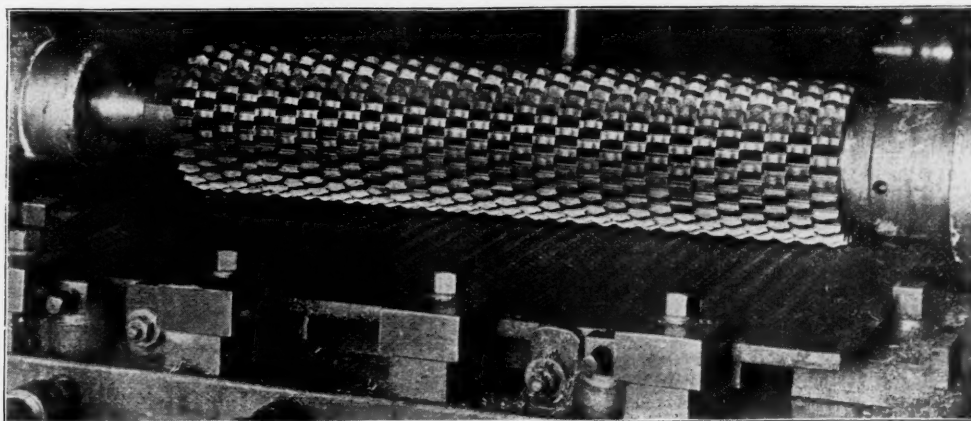
A couple of interesting engines for fast and heavy passenger service have lately been delivered to the Boston & Albany, from the Schenectady Locomotive Works. These locomotives were designed and built to haul the Boston and Chicago special limited trains, consisting of six vestibuled Wagner cars, between Springfield, Mass., and Albany, N. Y. The schedule calls for 103 miles in 183 minutes, with one stop, and the run being over a mountainous country much of the way there are heavy grades. For instance, eastbound there is a continuous grade of about 80 ft. to the mile for eight miles; westbound there is practically the same grade, 12 miles long. No helping engines are used. In fact, going east from the Hudson River to the summit, all the way, 58 miles, heavy grades are encountered; likewise going west from the Connecticut.

The builders of the engines were required to keep the weight on the driving wheels down to 74,000 lbs., and among other expedients adopted, a special tough iron has been a good deal used in place of ordinary cast iron, as for instance, in the driving boxes, the eccentrics and straps and the pistons. The iron used has a tensile strength of 30,000 lbs. per square inch. Therefore, with a piston of T-section, and a piston rod $3\frac{3}{4}$ inches in diameter, the weight is brought down to 304 lbs., the diameter of the cylinder being 19 inches. The cross head weighs 202 lbs. It has 18-in. wings in the top guides, 4 inches wide, with a pin $3\frac{3}{4}$ x 4 inches. The main rod, I-section, weighs 422 lbs.; side rod, also I-section, weighs 246 lbs.; main crank pin, 110 lbs.; rear crank pin, 104 lbs. The crank pins are of steel, and the main pin has the peculiarity of being hollow. We believe that this has been done before in a locomotive for the Lehigh Valley, at any rate we have recently seen designs of an interesting locomotive

<i>Cylinders and Valves.</i>	
Diameter of cylinders.....	19"
Stroke of piston.....	24"
Horizontal thickness of piston.....	$\left\{ \begin{array}{l} 4\frac{3}{4}" \text{ at rim.} \\ 5\frac{3}{4}" \text{ at hub.} \end{array} \right.$
Kind of piston packing.....	Cast-iron rings.
" " rod packing.....	U. S. Metallic.
Diameter of piston rod.....	3\frac{1}{2}"
Size of steam ports.....	18" long \times 1\frac{3}{4}" wide
" " exhaust ports.....	18" long \times 2\frac{3}{4}" wide
" " bridges.....	1\frac{1}{2}" wide.
Greatest travel of slide valves.....	5\frac{1}{2}"
Outside lap " " ".....	$\frac{7}{8}"$
Inside " " ".....	0" line and line.
Lead of valves, in full stroke.....	$\frac{1}{8}"$
Kind of slide valves.....	Richardson balanced.
" " " steam packing...	U. S. Metallic.

Wheels, Etc.

Diameter of driving wheels outside of tire.....	} Shrinkage and retaining rings.	69"
Tire held by.....		
Diameter and length of driving journals.....		8" x 11"
Diameter of engine truck wheels.....		33"



Pratt & Whitney Gang Milling Cutter, 33 Inches Long.

Diameter and length of main crank-pin journal.....	$5\frac{1}{2}'' \times 5\frac{1}{2}''$
Diameter and length of side rod crank-pin journal.....	$4\frac{1}{2}'' \times 3\frac{1}{2}''$
Driving box, material.....	Snow iron.
Engine truck wheels.....	Gun botless, steel tired.
Driving springs.....	Hung underneath the driving-boxes.
“ “ centers.....	42"
<i>Boiler.</i>	
Style.....	Extended wagon-lop.
Outside diameter of first ring.....	60"
Working pressure.....	190 lbs. per sq. in.
Material of barrel and outside of fire-box.....	Carbon steel.
Thickness of plates in barrel and outside of fire-box.....	$\frac{3}{8}$ ", $\frac{5}{8}$ ", $\frac{7}{8}$ ", $\frac{1}{2}$ "
Horizontal seams.....	Butt jointed, with welt strip inside and outside.
Circumferential seams.....	Double riveted.
Fire-box, length.....	90" $\frac{1}{8}$ "
“ width.....	40 $\frac{3}{8}$ "
“ depth.....	F. 71 $\frac{3}{4}$ ", B. 59 $\frac{3}{4}$ "
“ material.....	Snoenberger steel.
“ thickness.....	Crown $\frac{3}{8}$ ", tube $\frac{1}{4}$ ", sides and back, $\frac{3}{8}$ "

Fire-box, water space.....	{ Front 4', sides 3½"
" crown staying.....	back 3½"
" stay bolts.....	1" radial stay-bolts.
Tubes, material.....	Tray iron.
" number of.....	{ Charcoal iron, No. 13
" diameter.....	{ 3 W. G.
" length over tube sheets.....	298
Heating surface, tubes.....	29'
" fire-box.....	11'
" total.....	1,703.3 sq. ft.
Grate surface.....	141.4 sq. ft.
" style.....	1,844.7 sq. ft.
	25.20 sq. ft.
	{ Rocking, worked in
	{ two sections.
Ash pan, style.....	{ Sectional, with
Exhaust pipes.....	{ dampers F. & B.
" nozzles.....	{ Double.
Throttle.....	{ 3½" and 3¾" diam.
	{ Balanced valve,
	{ double poppet.
Smokestack—inside dia.....	14" at centre.
" top.....	16" at top.

Boiler supplied by two No. 10 Mack injectors placed right and left.

Tender

Weight, empty.....	37,200 lbs.
Wheels, number of.....	8
" diameter.....	36"
Journals " and length.....	4½" × 8"
Wheel base of tender.....	14' 2"
Tender frame.....	74 × 3½" × 1" angle iron.
" trucks.....	Side-bearing, wood bolster
Water capacity.....	4,000 galls.
Coal.....	8 tons
Total wheel base of engine and tender.....	45' 11"
" length of engine and tender.....	55' 7½"

Engine fitted with Westinghouse-American combined air-brake on front side of all drivers, on tender and for train. Martin's steam car-heating apparatus.

Interchange at Chicago.

As stated in a recent issue of the *Railroad Gazette* a committee was appointed at the September meeting of the Western Railway Club to consider the matter of interchange of cars at Chicago, and to devise, if possible, a scheme for facilitating their movement. It was left optional with the committee whether it should report to the Club, as it was not considered strictly club matter; but as a basis for a discussion which might help the committee the following preliminary report was submitted:

Whereas, The present method of inspecting cars at interchange points and requiring cards for all minor defects, merely to protect the road receiving the car, causes serious delay to traffic, necessitates the employment of a large number of men who spend their time in finding defects when it should be spent in repairing the same, and necessitates frequent repairs to pass inspection which are not required by any consideration of utility or safety, thus increasing the cost of car repairs; and,

Whereas, It is our belief that interchange of cars will be facilitated and cost of repairs reduced by owners of cars assuming responsibility for a larger number of items than at present.

We, the undersigned, agree to interchange cars with the understanding that, in addition to the defects enumerated in Rules 7, 8 and 9 of the M. C. B. Rules of Interchange, for which owners are responsible, the following items shall also be treated in the same way, viz.:

- | | |
|----------------------------------|--|
| 1. Couplers or Drawbars. | 7. End Sills. |
| 2. Drawbar Hooks. | 8. Longitudinal Sills. |
| 3. Drawbar Spockets or Spindles. | 9. Cracked Posts. |
| 4. Draw Lugs and Attachments. | 10. All Part of Trucks. |
| 5. Draw Timbers. | 11. Center Plates and all Body Castings. |
| 6. Dead Wood or Buffers. | 12. All Bolts. |

It is further understood and agreed:
First: That cars which are the property of the railroad companies, parties to this agreement, shall be inter-

changed between the parties hereto without requiring cards for defects which may exist in the parts enumerated above.

Second: That in receiving cars from railroad companies, not parties to this agreement, or in interchanging cars not belonging to parties to this agreement, the Rules of the Master Car Builders' Association for the Interchange of Traffic shall prevail.

Third: That nothing in this agreement shall be so construed as to require any of the parties hereto to accept cars which may in their opinion be unsafe to run, or unsuitable for carrying freight.

Fourth: That in case any party to this agreement should be required to furnish defect cards for any of the items covered by this agreement on cars owned by any party to this agreement, and a bill be rendered on such card, the bill and card shall be a voucher against the party owning the car for an amount equal to the amount of such bill.

Fifth: That if any party to this agreement should find it necessary or expedient to make repairs to any of the items covered by this agreement, the damage to said items not having been caused by wreck or derailment, then and in such case the party doing such repairs shall have authority to bill against the party owning the car for the cost of such repairs, the charges for labor and

material applied and credits for scrap or good material removed, being in accordance with figures established by the Master Car Builders' Rules of Interchange, and the party so billing shall certify on the face of the bill that the damage billed for was not caused either wholly or in part by wreck or derailment.

Sixth: That in case any party shall make repairs under this agreement, such repairs shall be made strictly in accordance with the construction of the car, and the parts repaired or renewed shall be stencilled with the initials of the road and the date such repairs were made, unless the shape or size of the repaired parts are such as to render such stencilling impossible.

Seventh: That this agreement may continue indefinitely, and that any party hereto may withdraw from the agreement by giving notice to that effect in writing to each of the other parties to the agreement, said notice to be given at least thirty (30) days prior to the date on which such withdrawal goes into effect.

These suggestions were, on motion, considered section by section.

Mr. Rhodes considered it a mistake to put in couplers and draw-bars. If they are broken on any other road, it surely must be the fault of the road that has had the handling of the cars, and why the road that has had that handling should not pay for such a breakage he did not see. To this criticism Mr. Barr replied that draw-bars are built to sustain the ordinary shocks of service, and in switching, and if they fail they generally fail in ordinary service, and in just exactly the service that they are called upon to withstand, so that while switching may damage a draw-bar, we do not find any fault with our men on the road for damaging a draw-bar. I think that nine-tenths of our couplers fail in sustaining the ordinary service that they were built to stand.

Mr. Barr here stated that he had a telegram from Mr. Grieves saying that the Baltimore & Ohio would agree to all items in the agreement except 7, 8 and 9, viz.: end sills, longitudinal sills and cracked posts.

In reply to an inquiry from Mr. Schroyer as to the benefit to be derived from a local agreement such as was proposed, Mr. Barr said: "We will not, of course, get anything like the full benefits out of this plan by entering into the agreement locally between us, but we will collect a large amount of data that will enable us to go to the Master Car Builders' convention and state with some authority how the thing works. And that is my object in bringing this thing up at present, to induce a number of you to go into this and find out something about it."

Mr. Waitt suggested that to the section providing that cars belonging to the companies entering into the agreement be interchanged between them without requiring defect cards for the parts enumerated, there be added the clause, "except when caused by wreck or derailment."

Replying to the objection of Mr. Rhodes that the proposed plan in taking the responsibility for the damage of foreign cars from the company doing the switching, was liable to result in rougher handling and greater consequent damage, Mr. Barr called attention to the fact that foreign cars could not well be handled roughly without doing damage also to home cars, and that protection to home cars meant protection to foreign cars as well.

Concerning the question of repairs Mr. Schroyer said: "Under rules of this kind we would do less work on foreign cars than is done by us to-day. To-day we cannot get rid of a foreign car that is at all defective, unless we put on a card or make the repairs. A great many of the inspectors prefer to have us make the repairs, and so they send cars back to us. It costs us 20 to 30 per cent. more to make repairs on foreign cars than on our own, for the reason that we have not got the timbers or castings in stock."

The discussion on the report was closed with the following suggestion from Mr. Rhodes: "Railroad companies that do not own equipment equivalent to . . . of their mileage, or that are engaged wholly in switching, are not to become parties to this agreement. Cars damaged by switching in yards will not be regarded as coming under the head of wrecks or derailments unless the damage to any one car exceeds . . . dollars."

New York City Rapid Transit.

I.—THE DISTRIBUTION OF TRAFFIC.

So far as the writer's observations have extended, the discussions of rapid transit by the New York Commissioners and their engineers and the numerous contributors to the public press, both editorial and amateur, have not included a consideration of the manner in which the traffic of rapid transit lines is distributed and the method by which uninterrupted progress from starting point to destination is to be assured to every traveller under the proposed plan of municipal construction and private operation of new lines of railroad.

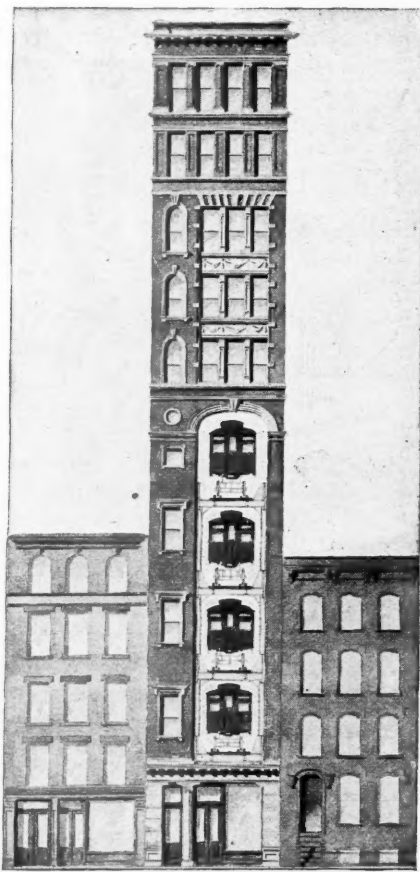
If all the passengers who travel up and down the length of Manhattan Island, or if even any considerable portion of them, took the trains at two distinct points six or seven miles apart and travelled only between those points, it would doubtless be entirely practicable for the trains to maintain an average speed of 40 miles an hour and "15 minutes to Harlem" would be easy of accomplishment, but after watching attentively the movement of travellers in and out of trains at all the stations all the way from the Battery to the Harlem River, one is led to doubt whether there are enough passengers travelling at the same time between the extreme points to warrant any corporation operating a railroad to run frequent trains for their accommodation only, to the exclusion of those who desire to alight from and embark on the trains at intermediate points.

To aid in forming some idea of the extent of the long distance travel, the accompanying diagrams have been prepared from data gathered at various times during the past 10 years. They are believed to represent, as nearly as it is practicable to do so, the proportion of passengers taking the trains on the Manhattan Elevated railroad in each one-half mile from the Battery to 162d street, a distance of 10 miles, separating the up traffic from the down traffic.

The scale of traffic is adapted to a daily movement of 605,000 passengers, which is about the average daily travel of last year. A change of scale would not materially affect the proportions of the up and down traffic in the several sections of the city which are indicated.

As nearly as can be computed, 25 per cent. of the up travel occurs between the hours of 5 and 7 o'clock in the afternoon, and 25 per cent. of the down traffic occurs between the hours of 7 and 9 in the morning and the proportion of the travel from the various sections of line at those hours is the same as the proportion for the whole day; so that the diagrams represent the heaviest traffic of the day both up and down, by applying to them a scale four times as great as the one indicated on the diagrams.

Looking at the traffic on all lines, 59 per cent. of the up travel comes from the three sections (a mile and a half) at the lower end, and 59 per cent. of the down traffic comes from the upper 10 sections (5 miles), so that the mean journey of 59 per cent of the passengers appears to be 6 1/4 miles. It now takes them three quarters of an hour to make this distance. It is desirable that they should do it in one quarter of an hour. To discover how this can be arranged so as to accommodate the greatest number of people, the points of departure of the greatest number of passengers on the several lines must be discovered and communi-



A Suggestion for Rapid Transit in New York.

tion provided between the maximum down traffic and the maximum up traffic points. There are two main lines, independent of each other, one on the west side of the city, carrying 47 per cent. of all the passengers, the other, the east side, carrying 53 per cent. The distribution of the traffic on these two lines is very different. This difference is best exhibited by arranging a table as follows, showing the proportion of 1,000 passengers making round trips, who take the trains in each half mile, on each line:

Section Number.		West Side.		East Side.	
		Down.	Up.	Down.	Up.
20	18	0	46	0	0
19	18	0	12	0	0
18	38	2	7	0	0
17	88	3	73	1	1
16	44	3	91	2	2
15	40	4	90	2	2
14	46	5	49	3	3
13	48	7	109	15	15
12	40	8	128	16	16
11	40	10	68	15	15
10	116	27	59	25	25
9	82	44	76	22	22
8	81	53	50	34	34
7	84	81	36	72	72
6	82	93	45	99	99
5	44	70	33	105	105
4	21	68	20	128	128
3	12	105	6	123	123
2	6	250	1	228	228
1	2	167	1	110	110
Total.....		1,000	1,000	1,000	1,000

NOTE.—Section 20 is between 162d and 152d streets; section 1 is between South Ferry and Cedar street.

This table shows that on the West Side, 44.5 per cent. of the passengers (sections 6 to 10), travel less than five miles and that to accommodate them stations not over one-half mile apart for the upper 2.5 miles and the lower mile and a half must be provided. That is to say, they cannot have rapid transit, which means stations at least a mile apart. It shows further that from the upper five miles of line 47 per cent. of the passengers come, and that they are so evenly distributed that stations a mile apart will not accommodate more than half of them at the best. There are only two sections, 17 and 20, in which passengers enough can be obtained to make long distance trains desirable or advisable.

On the East Side different conditions exist. The first five and a half miles from the Battery only furnish 29.5 per cent. of the passengers. The next three miles furnish 54 per cent. of the traffic, and as 59 per cent. of all passengers going up take the trains in the first two miles from the Battery, it appears that about 56 per cent. of all passengers on the line have an average travel of six miles and a clear run of 3.5 miles between extremes of pick-up and drop. From this three miles of East Side line (Secs. 12-17) there start down town every morning between 7 and 9 a. m. over 30,000 passengers and the indications are that at least two-thirds of them go south of Bleeker street. There are twice as many passengers depart from this East Side three-mile section (Secs. 12-17) in the morning hours as there are from any other district of equal extent in the city, and about three times as many as from the corresponding West Side district, and the total daily down traffic from this district is 40 per cent. greater than that from the next largest three-mile district, the West Side (Secs. 5-10), which accommodates most of the New Jersey and a considerable number of Brooklyn residents.

II.—THE RAPID TRANSIT COMMISSIONERS' PLANS.

This overcrowded three-mile section on the East Side, from 72d to 132d street, appears to be the portion of the city which most needs relief by additional lines for both quick and rapid transit, and yet it is the one district which the Rapid Transit Commissioners have not even suggested a plan for reaching, and which is not included in the elaborate subterranean scheme which they ask the citizens to vote to have constructed by the city.

Indeed, the whole study of the Commission seems to have been to provide speedy communication by the most expensive methods, between Whitehall street and Washington Heights, without considering the fact that from the West Side above 122d street there now comes less than 10 per cent. of the passengers who go down town on rapid transit trains, and that for three miles further down the road there are fewer passengers carried than on any other three miles north of Bleeker street.

At first glance this action is rather puzzling, but on consideration of the standing and environment of the Commissioners who reached the conclusions which have been temporarily adopted by the present Commission in order to enable a vote to be taken on the question of Municipal construction of the road, it appears less unnatural that they should have acted as they did. They were successful business men who had never held important public offices and who looked at everything from the point of view of the speculator, and felt in their hearts that a taxpayer is a sacred thing which must be protected and that a corporation is a diabolical and blood-thirsty thing which must be ground down, and that the public is of little account, anyhow. So they laid their lines to reach lands yet unoccupied, but which the owners want to bring into the market, they located them along public highways, to try and avoid purchasing real estate; they put them underground, so as to be out of sight; they demanded that the corporation should pay the cost of the most expensive methods of construction and besides pay to the tax-payers a large bonus for the privilege of benefiting their property, and should collect from the travellers a sum sufficient to cover all these expenses. In the proposition now submitted for approval of the voters, the burden placed upon the corporation is more onerous even than it was at first suggested. All details of the structures are to be prescribed and their construction superintended by the Board of Commissioners, who will have no pecuniary interest in their management and operation and will be governed in their requirements by their own fancy and their theoretical ideas based on no practice or experience, and who will not in any way be responsible in case of failure or inefficiency of the work and the methods they may prescribe. Moreover, municipal construction of a \$50,000,000, underground work is a dangerous undertaking. Remember the swindles of Riverside Drive, the stealings in the County Court House, the fall of the abutments of the 155th street viaduct, the frauds in the new aqueduct construction, and the Speedway.

The principles on which the whole scheme has been devised are faulty.

As regards practical working, tunnel railways have everywhere proved expensive to construct and uncomfortable and undesirable to travel in. Hopeful theorists alone claim that despite all experience up to the present time, some means in the future may be found to render them attractive, or even bearable for passenger travel. After searching everywhere, their engineer is obliged to confess that there is not in the world an underground road that is decent to travel in.

As regards political economy, the idea which underlies the project, that the city must receive compensation from

the corporation operating the railroad, is fundamentally erroneous. The creation of facilities for travel is beneficial to the owners of all real estate, and the burden of such creation should, in equity, be partially borne by the property benefited and not be imposed entirely on the travellers who are compelled to avail themselves of the facilities afforded. The parties furnishing the means of transportation must receive a fair compensation for their expenditure, and ought not to be compelled to demand from the travellers more than such fair compensation and then pay over the surplus to the taxpayers who have already received compensation in the form of enhanced valuation and increased rentals for their improved property. Justice can be done to all parties only by imposing on the property owners at large the cost of right of

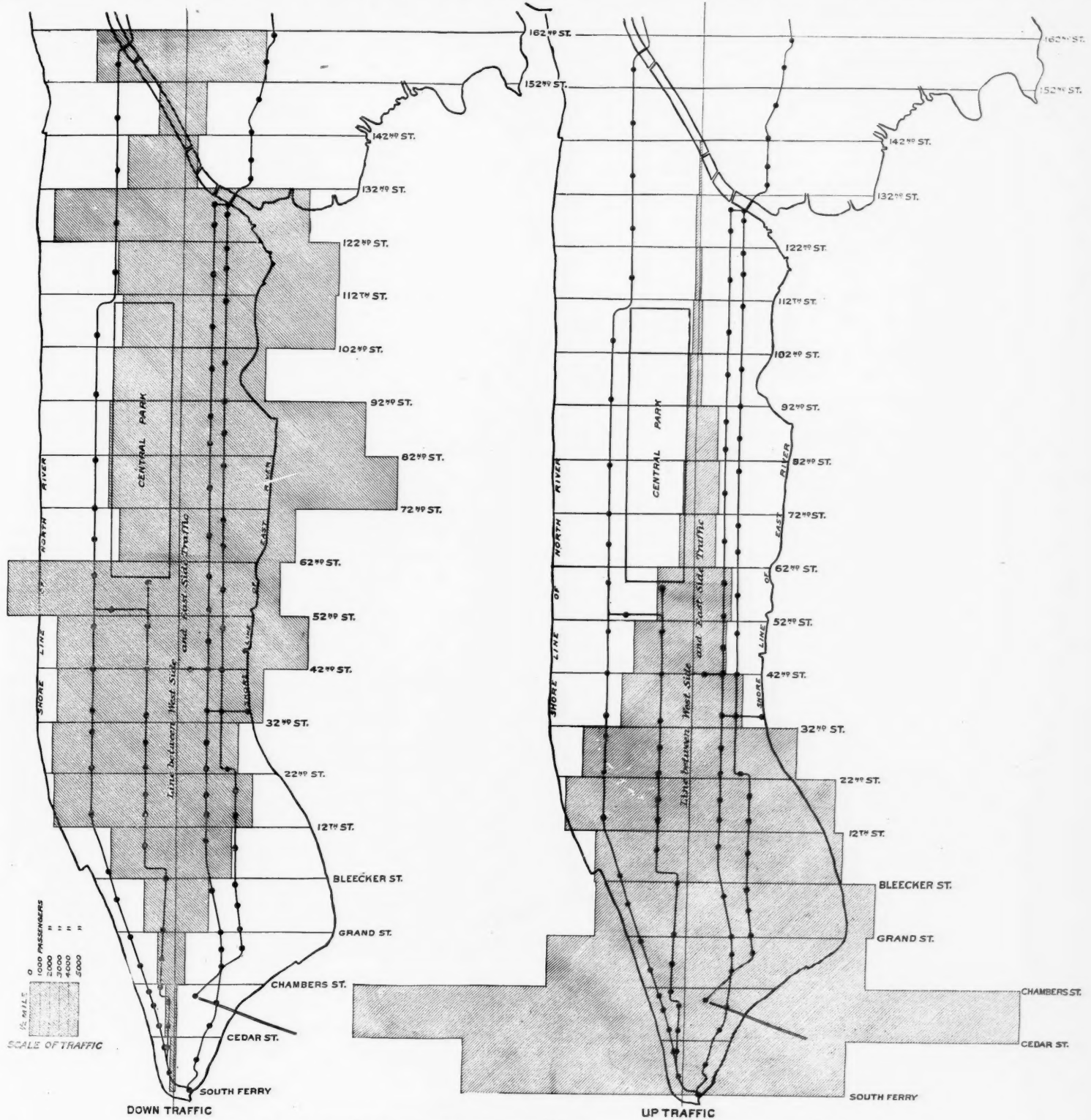
Under the law as it stands, the entire cost must be paid by the corporation, or if built by the city, the entire interest on the funds furnished by the city must be paid annually by the corporation, and in addition thereto the cost of furnishing the equipment of the road must be paid by the corporation, and the capital invested in this manner cannot receive any returns until the annual revenue from traffic shall exceed the interest on the bonds issued by the city, which interest must be at a rate one per cent. higher than the rate paid by the city.

Without altering the provisions of the proposed law at all, an additional section might with advantage be added suggesting to the Commissioners the consideration of a plan of construction and of finance, which might possibly obviate some of the objections to the bill as it stands]

tween which such communication is needed, and the assessors appointed by the Court to determine what persons may be benefited by such a street have the right to declare that the Mayor, Aldermen and Commonalty are the parties so benefited and to assess the cost of opening on them alone, and thereupon the Board of Estimate and Apportionment have the right to issue City Improvement Stock to pay for such cost (139, Cons. Act.).

If, however, it should be found necessary to amend the Rapid Transit Act, the amendments should comprise the following:

First: that the route designated for a rapid transit road, whether under or above the surface of the ground, be accurately defined both as to its horizontal and vertical limitations, and that the space included in such route be



DAILY TRAFFIC ON THE MANHATTAN RAILWAY, NEW YORK CITY ON HALF-MILE SECTIONS

Each square of half-a-mile on a side=5,000 trips; 10 numbered blocks=1/2 mile.

The numbered sections used in the table begin at the south end; e. g., No. 1 is South Ferry to Cedar Street, &c.

way, on the operator the cost of construction and operation, and on the traveller a limited payment sufficient to compensate the operator, but not great enough to also pay a bonus to the property owner.

Property benefited should compensate property injured, capital invested should be compensated by individuals benefited, and individuals benefited should be assured against excessive taxation for such benefit.

The law of the matter is defective in several points which have been pointed out by experienced municipal lawyers. Its great defect appears to the writer to be its not containing any suggestion or provision for the furnishing of a portion of the needed funds by the corporation and another portion by the city with provision for remunerating the city after the investment of private funds shall have become remunerative.

with respect to the burden imposed on the constructing corporation, the absence of any provision for the taxpayers who are very largely interested in the securing of a system of rapid transit, bearing a portion of the preliminary expenditure, and the absence of any definite provision for limiting excessive profits to both the taxpayer and the corporation by reduction of the burdens on the traveller.

Indeed it is not at all impossible that even without any legislation a better plan might be adopted by the Commissioners under existing laws.

The City Government, by the Board of Street Openings, has the right to locate and acquire for public use a continuous street of definite dimensions both horizontally and vertically for occupation solely as a means of rapid transportation of passengers between distant points be-

acquired by the city as a public highway under existing provisions of law and be paid for by the issue of city bonds. Such a purchase of a limited right of way would permit of the location of the structures of the railroad anywhere in space without limiting the right of the owner of the adjoining space above or below the railroad structures to occupy that space by building or otherwise. If the road were entirely above the surface of the ground, a building could be erected over and around it without infringing on the rights acquired by the city.

Another amendment would provide that when the traffic on the road as constructed should reach a certain limit which the experience of the last fifteen years in New York and Brooklyn has shown to be remunerative to the capital invested, a certain surplus should be devoted either to the extinguishment of the debt incurred by the

city in the purchase of the right of way and of contingent damages, or applied to the reduction of the rates of fare, thus tending to lessen the burden on the traveller and to increase travel also, or it might be applied to both of these purposes, as the Commissioners of Rapid Transit should determine.

The mode of procedure under such a law would be as follows:

(I) The Rapid Transit Commissioners to designate routes on the best lines for speedy traffic between various parts of the city and establish the grades on which that traffic should be conducted.

(II) The Board of Street Openings to lay out a highway to be devoted to transportation of passengers at speeds exceeding six miles per hour, and to designate and define both the horizontal and vertical limits of such highway; the lower vertical limit to be either below the surface of the ground, or at any specified height above it, and the upper limit to be at such height above the surface as to permit the passage of cars on the structure at the highest grade fixed by the Rapid Transit Commissioners at all points. This would be from 75 to 80 ft. in general. The width of the highway to be only sufficient for the construction of the necessary structures, which for a single track road would be about 14 ft., or for a two-track structure 25 ft., except at stations.

At the writer's suggestion, architects Small and Schumann have made a study for such a structure with surrounding building, which shows the effect that would be produced. This design is for a four-story one-track road, but in general a two-story double-track structure would be better. The structure need not occupy the ground floor at all, but might be entirely above the first story through blocks by building 220 ft. span bridges with 40 ft. span columnar abutments at the street crossings.

The rentable floor space of a ten-story building, such as is shown on the architectural sketch, would be reduced 50 per cent. in area, and 60 per cent. in renting capacity, leaving the value of the property 40 per cent. of what it would be without the railroad through it, and with a cable or trolley road in front of it. With a thirteen-story building, such as now abound down-town, the rental value of a 50-ft. front would be only reduced 22½ per cent. by putting through it a four-track railway.

(III) The Commissioners of Estimate and Assessment appointed by the Supreme Court, to award to the owners of property taken for such highway the value of the property, taking into account the fact that with present methods of construction of buildings, the space above the sequestered section of space would be available for occupation, provided that there was left on each side of the strip taken room for walls to support a building spanning the sequestered strip.

These Commissioners to assess the value of the sequestered property on the Mayor, Aldermen and Commonalty, and the Commissioners of the Sinking Fund to create a fund to pay for the same.

(IV) The Rapid Transit Commissioners to organize a corporation to construct and operate the railroad on certain conditions, as to strength of structure, kind of motive power, number and speed of trains, and rates of fare. To encourage travel, the maximum rate of fare should be fixed at five cents between any two points and provision further made that six tickets should be sold for 25 cents.

The route for such a road should be laid so as to accommodate the district most needing relief at the least expense. A single route can be made to include them all on both sides of the city, the length of line being 17 miles from the Battery to Kingsbridge, and the cost of the structure not exceeding \$15,000,000.

J. J. R. CROES.

Western Railway Club.

We give below abstracts of sundry discussions at the October meeting of the Western Railway Club.

ON COACH STEPS.

Mr. Waitt: I have no doubt eventually that the steps will be done away with, but it will be a great many years hence, and it will be when American railroads have more money to spare than they have at the present time. They may be abandoned to more advantage, I think, on suburban runs than they can anywhere else, but it is necessary, in order to do it successfully, to have regular platforms for exit, which cannot be used in connection with through service to advantage. With the through service, as it is on the line with which I am connected, it would be expensive and very inconvenient if we should attempt to change our platforms, and carry on the unloading of trains with raised platforms in terminal stations; and it would be quite a problem to figure out just the way in which it could be done, so that inspectors would have an opportunity to test the brakes, and the switchmen an opportunity to get in and out of cars, and give their signals, etc.; with the passengers going in and out at the same time. On postal, baggage and express cars, there is already a move in the direction of leaving off the platforms and steps, but on coaches and sleeping cars it seems to me that for a great many years to come steps will have to be provided.

Mr. Rhodes: It seems to me that what Mr. Waitt has said shows the whole thing in a pretty clear way. I do not think the question "Shall the coach step go?" was very well expressed as a topic. It might give the impression generally that it was somebody's idea that the coach step throughout the country is to be abandoned on account, I suppose, of its expense, and something else substituted, which of course would be much cheaper. I have here a pamphlet, "The Annual Report of the Railway Commissioners of Australia," from which it appears that the coach step has gone in that country. There is no coach step, I understand, on Australian roads, and it is very interesting to see the substitutes therefor. Here [referring to engraving] is a station with quite an

elaborate piece of masonry work throughout it, in the shape of a platform, and here is another one built in the same way. Now, on a line of about 2,000 miles, if you figure there is a station every five miles, there would be some 400 stations to fix up with this expensive masonry. We see at once how the question would be answered on a long railroad over here. On elevated roads, however, and on cars in purely suburban business, and possibly, as Mr. Waitt suggests, on baggage cars and way cars, I do not think there is much question but that the coach step is undesirable; and very few roads in the country handle elevated, or exclusively suburban, business do retain the coach steps. But in general, I think with Mr. Waitt, that the railroads will have to be a good deal richer before we see the day when the coach step will be abandoned.

Mr. Peck: Our trains could be unloaded much quicker if we dispensed with the steps. In leaving a coach now, the passenger advances only about eight inches per step for four steps, or 32 inches with four movements or strides; whereas, were the steps absent he would advance about as far with one stride, thus clearing the coach much quicker.

FREIGHT DRAFT RIGGING BETWEEN FLOOR SILLS.

Mr. Forsyth: I think that the C, B. & Q. was the first road to adopt this practice of doing away altogether with the draft timbers on freight cars. We commenced on low furniture cars in January, 1890, so that now we have had nearly five years' experience with that form of construction. The principal objection which was urged against it at the time was that it would injure the centre sills, which are such a permanent and integral part of the car, rather than the short, temporary draft timbers, which are not so important. Yet I have asked a number of our car men if they ever saw any of our centre sills with the draft rigging which were injured except by wrecks, and they told me no. In fact, I do not see how they very well could be with the protection of the iron plate that we use, and the connection of the draw-bar stops with that plate, by which we have the value of our bolts that are in the draft rigging acting in either direction, and the bearing of our iron plate against the end sill.

If other roads had gone into this construction five or six years ago, as we did, we would have a great deal less trouble with repairs to draft timbers and draft gear generally. After an experience of five years with this construction I can certainly recommend it as a very important improvement in the design of freight cars.

Mr. Townsend: My experience has not been the same as Mr. Forsyth's. We have quite a number of low, flat cars built in this way and we knock them out, and it costs a good deal more to put in a centre sill than a draft timber.

Mr. Watt: We have 700 cars equipped that way. They were not constructed in order to do away with draft timbers, but were extra high and extra wide, and still had to go safely through the tunnels of the New York Central Road to New York. We accordingly had to keep our car floor framing down, and it was necessary to provide for having a draft rigging between the centre sills. In order to do this, and avoid as far as possible the likelihood of the tearing out or breaking of the centre sills, in case the cars should get a severe blow that would knock the draft rigging out, we reinforced them on the inside with pieces about 3x8 that went back beyond the bolster, and were well bolted to the sills. The side castings for the draft rigging were fastened to these auxiliary pieces. As far as I am aware we have had but one car that had to have the centre sills removed on account of the draft rigging being torn off, and that was a car that had the centre sills and some of the intermediates broken; but it was in a wreck and the car was pretty badly demolished. As far as my observation has gone, if the rigging is properly put in there is no reason why it should not be fully as substantial and satisfactory as the old arrangement with the draft rigging down below. Two hundred of these cars have been running for two years; the balance have been running for five or six months; but I surely would have no very strong objection to that rigging from personal observation.

Mr. Barr: I do not believe that we are quite in position to say from results that have been obtained from these cars, that the cost of repairs would be increased by building them in this way. If, as Mr. Watt says, you put short pieces on the inside of the sills, you can then remove those short pieces, and it will not cost any more than to remove draft timbers; but if we go to the other construction, and fasten the draw-bar attachments directly to the sill, I feel satisfied that it is going to increase the cost of repairs, although it may not be shown now. The ordinary switchman handles his business by the way he breaks his cars. These cars do not break and the old cars do. He is limited in the way he handles them by the way the cars break. When the old cars disappear, and we have nothing but these, the switchman is going to increase the force of his blows, and I am mistaken if we do not find the cost of repairs increased.

Mr. Schroyer: I have looked at the adoption of a car body of that sort as a bid for freight rather than a measure of safety and strength in construction. Our competitor will put in a car that has got a little more cubical area because he lets his floor down, and he bids for freight on that ground. Five years is not a proper measure of the correct construction of a car. I am not prepared at the present time to say what percentage of draft timbers are put into Northwestern cars, but I feel sure that the percentage of draft timbers put into new cars the first five years is very small, unless the removal is due to wreck.

Mr. R. D. Smith: I wish to endorse what Mr. Forsyth says in regard to the fastening of the draft rigging to the centre sills and to give our experience from the repair yard standpoint. During the five years that we had this draft rigging on our cars we have not had, to my knowledge, a sill that was broken by reason of the draft rigging being fastened to it. The draft rigging and sills of the cars are practically in as good condition as when first applied and the sills have no re-inforce pieces to strengthen them. As first designed, a wrought iron plate was placed next the sill; and on it, and bolted through the sill, were placed the draw lugs which depended entirely on three bolts to hold them. The shrinkage of the wood in the sill would loosen these bolts enough to make a shear of the wrought iron pieces and the result was that, in switching service, the shock given the back or buffing draw lug would shear the bolts. To overcome this trouble, the wrought iron piece placed next the sill was made somewhat longer, and the ends flanged to make a stop and an oak piece was placed between this flanged end and the iron transom. Since that change, we have not had a bolt to remove on account of shearing or bending, and I have lately examined cars when jacked up on our repair track, and found the draft rigging and sills in as good condition as when first put up. I do not believe that a car builder will claim that draft timbers applied in the ordinary way, under the sills, will give a life of five years and be in good condition at the end of that time. By fastening the draft rigging to the centre sills, we do not have

to maintain the draft timber bolts which, we all know, are quite an item of expense.

Mr. Potter: The Pennsylvania road, two or three years ago, built 200 or 300 furniture cars in that way, placing the draft rigging between the sills, and I believe they are the most substantial cars we have in service. I have yet to hear of one of those cars failing as far as the draft rigging is concerned. It enables us to use a plate on the end sill so constructed that a hole passes through it, through which the draw-bar is applied. The metal which is removed to form that hole is in the shape of a flange surrounding the hole which gives a bearing surface for the coupler and also strengthens the plate, making something in the form of an angel iron. With a construction of that kind the Master Car Builders' coupler could be changed so that it would be very materially benefited; that is, the guard arm could be made so that it would form a bearing on the end sill so that any shock which the guard arms might take up would be transferred directly to the end sill by a pressing strain rather than by the strain that they are now subjected to.

Mr. Rhodes: I want to endorse what Mr. William Forsyth has said, and what Mr. Smith has corroborated, about his experience in handling cars. There is one question which has been asked. It has been asked why this should be a better form of draft rigging than that attached under the sill? The reason is, that the line of draft and shock is raised above the bottom of the sills, and the leverage of the attachments therefore is reduced to very much less. In a paper presented to this club by Mr. Barnes in January, 1892, on "Recent Progress in Car Construction" he called particular attention to the under framing of cars and the importance of strengthening it, and outlined what the results might be if it were made of iron or steel. In speaking of this particular kind of draft rigging he said of those roads that were using this form of attachment that their next move would be to have these two center sills of steel or iron with this attachment to them, not below the bottom of the sill but in line with the draft.

Guard Rail Clamp.

One of the devices exhibited at the Roadmasters' Convention in New York, by the Pennsylvania Steel Co., was a guard rail clamp especially adapted to securing the rails with any desired space between their heads. In Figure 1 the clamp C C' is shown secured in position, the fillers D and D' and the liners e and e' determining

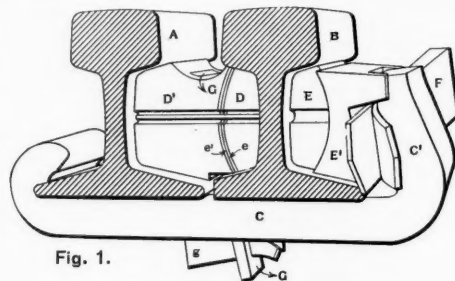


Fig. 1.

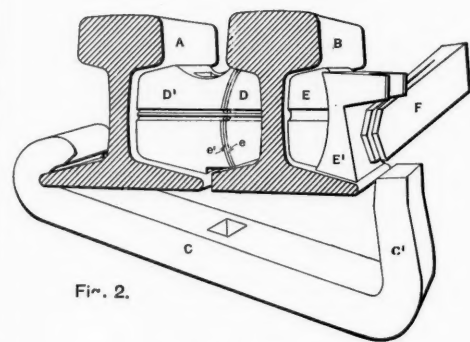


Fig. 2.

Guard Rail Clamp.

the space between the rail heads A and B. A key G passes through D' and C' to prevent lateral motion between them and is secured by the split wedge g. The packing pieces E and E' are placed outside the guard rail and the split wedge F binds the clamp. Figure 2 shows the method of applying the device. To make a slight change in the space between the rail heads the positions of the liners e and e' would be altered, while a greater change may be secured by interchanging the filler D and packing piece E, which differ in thickness, but in all the changes the fit of the clamp is not changed. For convenience when putting them in the parts used for filling are fastened together with a wire shown in the cut. Projections and recesses not shown interlock fillers D and D', also packing E and E'.

This is a new combination of parts heretofore used by the Pennsylvania Steel Co. The combination was designed by Mr. G. W. Parsons, Superintendent of the Frog, Switch and Signal Department of that company, and a patent is applied for.

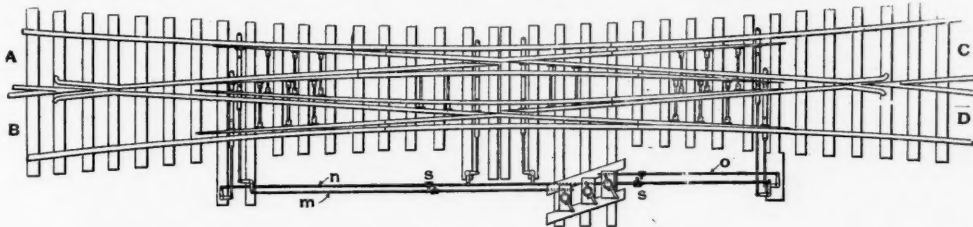
The object aimed at was to be able to secure the guard rail with such flange spaces as would be requisite with 4' 9" gage, and with 4' 8½" gage, also to overcome the effect of wear of the guard rail, and to avoid, in the changes, any variation of the total dimensions of the parts inside the clamp. Thus the taper of the wedge is in reserve, to counteract the effects of wear generally. Parts D and E fit interchangeably, and each interlocks with the adjacent parts. The new points are making the filling and the packing each compound and interchangeable, by which to vary the flange-way, without affecting the fit of the wedge and clamp.

Vernon and Ellis's Interlocking for Movable Point Frogs:

The drawing herewith shows an arrangement of stands and levers for simultaneously moving the points of a movable frog and two pairs of the switch rails which operate in connection with the frogs. The design of this invention is to provide the safeguards of interlocking at places where there is not a regular interlocking frame. By the use of three switch stands with the rods suitably interlocked, it is made impossible for the switch tender to give a route at the switches that conflicts with the route given at the same time at the movable points which act as frogs.

The middle stand, as will be seen by the drawing, operates both pairs of frogs and the two switches in the line of track B C; while the other stands, through rods *m* and *o*, respectively, operate the other two switches. The interlocking is effected by the lugs attached to the rods at *s*.

The track from A to D is the main or more important



Vernon & Ellis' Interlocking for Movable Point Frogs.

line, and the switches, in the figure, are set straight for this line. To change them, the attendant must first move rods *m* and *o* so that if a train should approach on the main track before he completed the operation of changing the frogs it would be thrown through the slip instead of being derailed at the frog. To restore the main track the frog points and the switches operated by rod *n* must be moved first, and then the other two switches. Thus a train on the main line from either direction always has a path open to it. The inventor has also provided an arrangement whereby the apparatus can be operated with only two stands.

Mr. Vernon is Superintendent of Interlocking on the Old Colony (New York, New Haven & Hartford) and Mr. Ellis is well-known as having been for years Roadmaster on the New York, Providence & Boston, and prominent in the Roadmasters' Associations.

The M. C. B. Coupler in 1894.*

The subject of the paper which I have been asked to prepare is still a very important factor in Car Equipment, and is becoming more so as the number of locking devices increases, and the field from which to select is extended. The past year has been one of very considerable improvement and development in the M. C. B. coupler, and not only have the coupler manufacturers sought to improve the design of their devices, by simplifying and by adding strength to weaker parts, by means of a better distribution of metal, but there has also been an honest effort to decidedly improve the quality and uniformity of the metal used.

There will, doubtless, for a long time, exist a marked difference of opinion among railroad men and manufacturers as to the relative merits of malleable iron and steel for the construction of coupler castings. I have always been a believer in malleable iron as the safest all around metal for such use, but having heard great claims made for steel during the past few years my faith in malleable iron began to waver, and I thought that perhaps after all I was away behind the times. I am to day resting again more firmly in my faith in the malleable iron coupler as the safest, surest and best. I would not say that in a pulling test the best malleable iron would outlast the same section of best steel; but I believe that to-day more reliability can be placed on getting a uniform result in quality and strength with malleable iron, than can, with the most approved methods, be placed on getting reliability and uniformity in cast steel. There seems to be a peculiarity in steel castings by which certain elements separate themselves and concentrate at some one point in the metal, leaving other parts lacking in those elements, and thereby rendering such parts weaker than others, and leaving the steel not uniform in density, and varying considerably in percentage of carbon. Undoubtedly the time will come, before many years, when cast steel will be made with absolute uniformity and free from the blow holes. Until this time arrives manufacturers should use every effort to raise the standard in malleable iron to its highest point.

I cannot refrain from calling attention to the reprehensible practice on the part of a few coupler manufacturers, during the past year, to take advantage of the results of the M. C. B. coupler tests in 1893, by carefully figuring out some unimportant class of results in connection with those tests, where their coupler made a good showing, and then sending broadcast circulars with the name and record of their coupler in large full face type, claiming that they showed the best record as shown by the official report of the M. C. B. tests, when in fact, by reference to the complete official records, they showed only the most ordinary results.

It is quite noticeable that the past year has seen very few prominent additions to the list of coupler companies, and it is a fact worthy of rejoicing over, when it is considered that every new design of coupler put on cars means that hundreds of points must be supplied with special knuckles and locking parts for making quick repairs. May we not hope for and advocate a movement among coupler companies, or railroads, that will in some way reduce the number of different styles of couplers, or at least will modify some of them enough so that the principal makers will be able to use the same knuckle pin, and similar uncoupling levers and brackets? With

such a result possible of realization, we might be willing to approve of the coupler manufacturers making modifications which would, for the time being, interfere with interchangeability of some parts of the couplers in cars now equipped, but which would lead to a more general interchangeability of the wearing parts of several, or all, makes of couplers after a few years.

Among the articles written the past year on the coupler question, there appeared, some months since, an editorial giving a copy of certain recommendations in connection with the selection and use of M. C. B. couplers, which, it seems to me, advocated at least one step in the wrong direction. It was suggested that, as the principal coupler patents had expired, each railroad company could design their own couplers and have them made by malleable or steel makers, subject to certain tests. I believe the railroads of this country will rue the day that a move in this direction is made. We are at present suffering great expense in the way of large amounts of money tied up in dead coupler stock at shop and inspection points, and if each road is to design couplers to suit the officers' ideas, there would soon be as many varying designs of M. C. B. couplers, each differing from the others enough to prevent principal repair parts from being interchangeable, as there are now of varying styles and shapes of link and pin couplers, whose name is legion.

Another serious result would be, that the tendency of

some purchasing agents to drive sharp bargains, and get wonderfully low bids on material that they know little about, would be aroused and given full vent, with the result that more poor metal and defective workmanship would be gotten on to cars than could be overcome by strongest efforts of able mechanical men for years.

Believing that it would be of interest and profit to collect as much data as possible, in connection with the practical working of various makes of M. C. B. couplers, I have written to about 40 different railroad companies, in different parts of the country, asking for such data as they could furnish me. Unfortunately the larger proportion of the roads communicated with have no definite information which they could furnish, but I have tabulated the limited information received, and hope it may prove of interest.

But little information, other than the comparative weaker points of each coupler, can be obtained from that portion of the tables covering breakage in other than home cars. In the data in connection with home cars a fair comparison is had of the relative breakage or weakness of certain parts of one coupler, as compared with another, and, also, an idea as to the probable percentage of yearly breakage to be expected in the M. C. B. type. It will be noticed that in the reports of some roads certain couplers show no breakage in either knuckle or coupler casting. This must not be taken as proof that such coupler is necessarily the best, as invariably these same couplers show considerable breakage in the columns of foreign cars on other roads, and in some cases at least it is certain that the number of cars shown were not running during the full time indicated in the table.

From what seems to be the most reliable data from a reasonably long record, it would appear that the coupler casting breakage, where a road has 100 or more cars in continuous service, runs from 75 per cent. to as high as 17 per cent. per year, and the knuckle breakage from 50 per cent. to as high as 20 per cent. The general average thus having been far above what economical service would permit. It is encouraging, nevertheless, to note that the result of this great breakage and consequently great replacement by the manufacturers, together with the very valuable information derived from the careful work of the M. C. B. Committee on Automatic Couplers, has begun to produce results that augur well for the permanence and stability of the M. C. B. type of coupler in the future.

One of the best records shown in the statements I have been able to obtain, and one where all the facts are known and have been verified by me, are shown in an 1894 development of coupler, which has been in miscellaneous service on 403 cars, for an average of six months, with an actual breakage of only four coupler castings and not even one knuckle, or an average of only 1.2 per cent. per year of couplers broken; and this result was obtained with a malleable iron coupler.

A reason may be given for the best results now being obtained with the M. C. B. coupler, from the fact that the strongest couplers are in each case being manufactured by the coupler companies themselves, and are not made for them by manufacturers of malleable iron or steel, who must produce the goods so as to make a fair profit, in order to do business, and who have but little interest aside from that in the durability of the material.

It is an unfortunate fact that the early designers of the M. C. B. couplers chose 5x5 in. as the outside dimensions of the shank; but as not nearly one-half of the freight equipment of the country has yet been fitted with the M. C. B. coupler, and as the larger part of cars already equipped can readily be adapted to the change, it is to be earnestly hoped that at the next M. C. B. convention some positive action will be taken to at once remedy the present weakness in our standard coupler, by increasing the shank section by ½ in. each way, thereby enabling the adding of considerable strength in supporting the weak guard arm, as well as giving great additional strength to the shank.

I have obtained some interesting data as to coupler repairs at two large interchange stations and found by comparing the experience at one point with that at the other, that no reliable data can be obtained on which to form a safe judgment as to the comparative efficiency of any one coupler as related to the others. It will generally be found that such records show the best results with the couplers most used on the roads whose termini are at the station named.

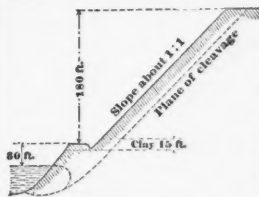
Too great praise can not be given to the very efficient and valuable work of the M. C. B. Association Coupler Committee during the past two years for the patient work and valuable information deduced by them, and it is safe to say that their good work, together with the careful analysis by the coupler manufacturers of the breakages they have met with in their devices, is going, in the immediate future, to give to the railroads of the

country M. C. B. couplers which will be a source of greater economy and safety than railroad mechanical men ever imagined when the M. C. B. standard coupler was adopted.

Hydraulic Excavation of a River Bluff.

Mr. Don J. Whittemore, Chief Engineer of the Chicago, Milwaukee & St. Paul Railway, sends to the *Journal* of the Association of Engineering Societies the following interesting account of his experience in excavating a bluff by means of a hydraulic jet.

The line of our road at Sioux City follows along the river, and in and under the bluffs for a distance of over one mile. The roadbed was constructed by cutting a notch in the bluff-side, about 30 ft. above the level of the river. (See sketch herewith.) The bluff-slope extends from grade to a height of from 100 to 180 ft. The Missouri River undercut our roadbed, and within an hour after passing over it with a passenger train, a section of 800 ft. in length slid into the river. The plane of cleavage was about 15 or 20 ft. back of the face of the slope. To restore the roadbed,



our company secured, by my advice, hydraulic machinery, and, at the close of 1883, we had washed some 300,000 yards into the river, and had formed a roadbed sufficient for restoring the track. During the summer of 1884 we prosecuted the work still further, and removed from the bluff into the river about 700,000 yards, at an expense of 2½ cents per cubic yard.

The bluff being so high, it was dangerous to employ the water-jet without having at all times complete control of avalanches. This was accomplished by the employment of powder in throwing down material when it had become sufficiently undercut by the water-jet, and before there was danger of an avalanche, unaided by other forces than gravity. The amount expended for powder was about 1 cent per cubic yard of material moved, leaving the actual cost of hydraulic excavation, exclusive of powder, 1½ cents per cubic yard. All the material thus removed was not of the general character of bluff material along the Missouri. Just at and above grade, there was a streak of pretty tough clay, that varied in thickness from 10 to 15 feet, and in this the water-jet would not work until the clay had become disintegrated by powder. Were it not for this clay, and for the necessity of controlling avalanches, I am sure the work could have been accomplished for about 1½ cents per cubic yard.

Engineers in charge of improvement of the Missouri and Mississippi Rivers have had remarkable success in the use of the water-jet, and I am surprised that some of our members have not heretofore published full accounts of such work. Meagre accounts can be found, I think, in some of the publications of the United States Engineer Department.

Track Elevation in Chicago.

The plans of the Chicago & North Western for the elevation of the tracks of its Galena Division in Chicago, are practically completed, though they have not been passed upon by the City Council and can not yet be considered as final. They are said to have been drawn up, however, in accordance with agreements made between the officials of the railroad and the city authorities as to the elevation, the subways, and other important points, so it is probable that the proposed plans will be acceptable to the city. But few of the details have been given out, though it is understood that in the case of streets on which it is proposed to build trolley lines the subways will have a clear height of 14 ft. 6 in. instead of 13 ft. 6 in. as provided in the ordinance for the elevation of the tracks of the Lake Shore and the Rock Island roads. At other points the clear height of the subways will be 13 ft. 6 in. The difference will generally be in the depression of the subway, however, and not in the elevation of the tracks. At West Fortieth street a change in the elevation will probably be found necessary on account of the shops and yards of the company. It is said that as soon as the present scheme is disposed of, the railroad company will take up the problem of elevating the tracks of the Milwaukee Division of the road.

It is reported that an agreement has been reached between the various interests concerned in the elevation of the tracks of the St. Charles Air Line, and that an ordinance will soon be presented covering the details of the work.

Foreign Railroad Notes.

The large reduction in passenger and express rates in France last year resulted in an important increase in traffic on the Paris, Lyons & Mediterranean Railroad, the greatest of the French systems. The number of passengers increased 10 per cent., and the number of cattle carried increased 160 per cent. But the increase in gross earnings was inconsiderable (\$762,000, or little more than 1 per cent.), and as there was an increase of \$2,211,000 (6½ per cent.) in the working expenses, due to the heavier traffic, the net earnings decreased \$1,449,000 (4 per cent.).

The French Minister of Public Works has warned the

*Paper read by Mr. A. M. Waitt at the October meeting of the Western Railway Club.

railroads to use greater care to detect shipments of freight represented to be of a lower class than that to which they really belong, or of less than their actual weight, to the disadvantage of honest shippers. When such cases are detected, the Minister says, the companies should not content themselves with collecting the full amount properly due for the freight, but should cause the delinquents to be prosecuted criminally—for in France this method of obtaining value by false pretences is a crime before the law.

That the French Government always makes its contracts in unmistakable terms, is generally supposed, and uncertainty in the terms of an agreement involving many millions and a long period of time is the last thing that would have been expected from it; yet two of the great railroad companies of France, the Orleans and the Southern, claim that the contracts made by them with the Government in 1883, whereby the latter guaranteed them a certain profit per share, run till 1956, while the Minister of Public Works says that the guarantee will expire at the end of 1914.

It is not for armies alone that the military conditions of Europe require sacrifices from the people. A considerable system of narrow-gauge railroads has been built in the south of France, interest on the cost of which was guaranteed by the Government on the ground that they were needed for the national defence. How far these lines are from serving an economical purpose appears from their earnings and expenses. The lines of the South of France Company, which are called lines of "public interest," earned gross \$186,120 in 1893, while their working expenses were \$270,144, or 145 per cent. of the earnings. Its local line from the winter resort Hyères to San Raphael, 52 miles, lying a little back from the Mediterranean, close to which is the main line of one of the great companies, earned \$52,015, and paid for working expenses \$70,574. It has been in operation four or five years. Its local system of the Côte d'Or, 91 miles, cost \$88,249 to work, and earned \$68,524. Nothing but the State guarantee keeps these lines going, and the payment of this causes much growling of tax-payers.

The International Sleeping Car Company, a Belgian corporation, is a sort of European Pullman on a much more modest scale, both because sleeping cars are much less common in Europe than here, and because this company does not have so large a part of the business to itself. Last year was the seventeenth in the history of the company, and in this time the length of lines over which the company's cars run has increased from 6,023 to 39,784, the number of its cars from 58 to 400, and its gross earnings from \$108,370 to \$1,144,288. In the last year its expenses absorbed 56 per cent. of its earnings, and after paying fixed charges, including a large amount for retiring bonds, a dividend of 3½ per cent. was made.

On the Prussian State Railroads in the year to March 31, 1893, the payments for pensions to the permanently appointed employees (not day laborers) amounted to \$2,317,704. Toward the funds which provided these payments the employees themselves contributed \$517,864, the railroads (charged to working expenses) \$480,000, and the balance came from the accumulated pension fund, which at the close of the year amounted to \$9,864,000. About 56 per cent. of the payments went to retired employees, nearly \$800,000 to widows, and \$220,000 to orphans.

The Prussian State Railroads in 1892 had in their service an average of 188,958 workmen entitled to insurance payments in case of accident. The payments to these men for insurance amounted to \$411,552, which is equal to \$2.18 per employee. The year before these payments had been at the rate of \$1.70 per man. This accident insurance is, we believe, in accordance with general laws of recent date, which apply to nearly all industries, and not to railroads alone.

Under the new administrative organization of the Prussian State Railroads, which is to go into effect April 1 next, a special distribution of the lines (15,800 miles) into eight groups will be made solely for the purpose of making rates; for there will be 20 "directories," or administrative units. Each of the eight rate groups will have a local tariff of rates, and a joint tariff with each of the other seven groups. At present there is a tariff for the system of each of the 11 directories, with joint tariffs, bringing up the whole number to 66, which will be reduced to 36 under the new system.

On the popular 'dion,accor' or 'D' trains, on the, Prussian State Railroads, which are modifications of our limited trains, the passenger formerly paid 1 mark (24 cents) for a reserved seat in a third-class car, and 2 marks for a first or second-class car seat, whatever the length of his journey. Last summer these charges were reduced one-half for passengers traveling not more than 150 kilometres (93 miles).

The Belgian State Railroads had a favorable year last year, their gross earnings having increased 3½ per cent., but the 1892 earnings were the smallest for three years. For six successive years the gross earnings have been:

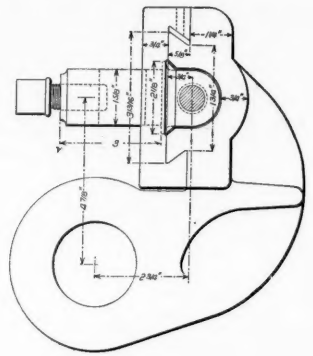
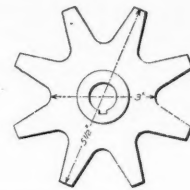
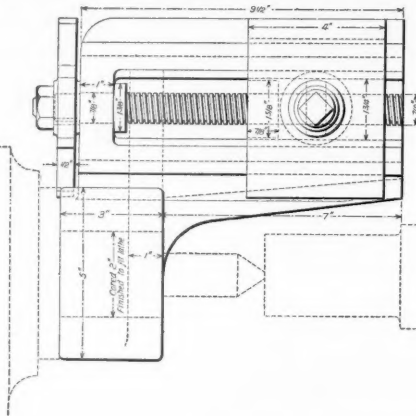
1888.	1889.	1890.	1891.	1892.	1893.
\$24,714,647	\$25,799,077	\$26,503,270	\$26,788,008	\$26,397,381	\$27,307,029

The increase since 1888 is 10 per cent.; since 1891, 2 per cent. Passenger and freight earnings have grown with nearly equal rapidity.

A Lathe Attachment for Turning Tumbling Shafts.

Those who have had occasion to turn up the bearings of locomotive tumbling shafts are well aware of the difficulties to be encountered in a shop having no special appliances for the work, the length of the arms being such that it is often difficult to find a lathe of sufficient swing to allow them to clear the bed of the lathe. Among the attachments intended to obviate the necessity for so large a lathe is that shown in the accompanying illustration and used in the Chicago shops of the Chicago & North Western Railway.

By the use of this device the bearings of the shaft can be turned up on almost any lathe having sufficient space between centers to take the shaft. It is screwed upon the live spindle of the lathe in place of a face plate and revolves about the work. A short bed planed parallel to the center line of the lathe, carries a small saddle bearing



Attachment to Extension Lathe for Turning Tumbling Shafts.

a tool post in which a tool is mounted with the point projecting inwardly to the shaft. A ¼ in. screw with six threads to the inch, controls the movement of the saddle along the bed, the movement of the screw being governed by a star feed. The device has been in use in these shops for several years and has given very good satisfaction.

The Mississippi-Superior Canals.

Among the canal projects receiving partial endorsement by the present Congress, was one to connect the waters of the Mississippi and Lake Superior by a navigable canal, and \$10,000 was appropriated for a survey to determine the feasibility of the project. It is said that Major Sears, U. S. Engineer Corps, who has the survey in charge, hopes to have it completed before next spring. Undoubtedly the \$10,000 can be easily and profitably expended by that time, but the problem is an important and intricate one.

Two main routes, each with variations, have been proposed; one via the St. Croix River, with three different outlets into the Lake, is somewhat objectionable to Minnesota interests, as the St. Croix empties itself into the Mississippi below Minneapolis and St. Paul, and the St. Croix route leaves those two cities to one side. Of the various lake terminals of this route the most advantageous commercially is the one by the Nemaji, or Left Hand, which would introduce river steamers and barges directly into Superior harbor.

Another route is via the Upper Mississippi. This, of course, will accommodate the "Twin Cities." Some advocate the ascent of Rum River to Mille Lacs, beyond which a low summit would be crossed with a descent into the St. Louis River and Superior harbor. Investigation will possibly show that the small gathering ground and large surface of Mille Lacs render this a precarious source of supply for a large lockage.

The remaining route would follow the Mississippi to Sand Lake, the waters of which are said to discharge into both the Mississippi and St. Louis. This would be a longer route, and with more lockage than any of those above mentioned. But the aggregate water power developed on the Mississippi, including the Meeker's Island dam, would probably be twice that at Minneapolis, and the lockage toward Lake Superior would, if the plans of the Duluth Canal & Power Co. are carried out, be all concentrated at Superior harbor.

This route, via Sand Lake, also presents one advantage over others that should not be neglected in any summary of economic results, viz: It would easily lend itself to a connection with the Red River of the North. This is possible by Lake Winnibigoshish and Red Lake, but possibly a route via the Crow-Wing River and Otter Tail Lake would be cheaper. This route would also serve a better country than by Lake Winnibigoshish. A navigable connection with the Red River would be a great boon to the inhabitants of Dakota, and would add appreciably to the wealth of Manitoba, a country that will for many years be tributary to the cities on the great lakes.

It will be seen from the above that there are so many conflicting interests involved that no exhaustive report can be made on a \$10,000 survey.

Notes on Steel Sleepers.*

In 1889 on the Multan District of the North Western Railway of India, about 55 miles of 60-lb. F. F. rails were replaced on wooden sleepers by 75-lb. F. F. rails

*Extracts from a paper read by Mr. W. H. Cole, A.M.I.C.E., before the Institution of Civil Engineers.

on steel sleepers. In 1890 most of the renewals were made with wooden sleepers, but in 1892-93 the author had charge for some months of the Sindh Sagar District of the North Western Railway of India, nearly the whole of which—about 300 miles—was laid in 1886 with steel sleepers in sand, with a stone or brick ballast topping. Unfortunately, the soil of sand and clay is throughout more or less impregnated with saline matter. The air is generally very dry, but that portion of the line which runs westward between the Salt Range and the right bank of the Jhelum River towards the Indus is for months exposed to inundation, and is saturated by drainage from the hills. Here marked sleepers, which weighed 1 cwt. 1 qr. 8 lbs. in 1886, were found to weigh on the average only 3 qrs. 3 lbs. in 1890, a loss of 2 qrs. 5 lbs. in four years. At the beginning of 1893, it was determined that wooden sleepers should be substituted for steel sleepers when renewal became necessary. Guided by the results of experiments with sleepers buried in sand on the East Coast Railway, the authorities decided not to use them within 10 miles of the sea.

Steel sleepers hold well in line and surface now that great care is taken to ensure good surface contact be-

tween the jaw and the rail. Formerly the contact was very imperfect, and the gage was exceedingly uneven. Another advantage in Indian practice is that, though the rails may buckle, there is no "creep" with a steel sleeper road. Adjustment of gauge in curves is sufficiently obtained by driving one or both keys inside, instead of outside. After a year or two, when a clean gravel ballast has been well packed into the trough and the sleeper has been made solid, with a good bed of ballast below and a sound bank, fewer men per mile should be able to maintain the road, so long as the sleeper lasts. But on soft embankments, of such material as black cotton soil, which takes years to consolidate, it is far more difficult to pack a steel sleeper road than a wooden one, especially during the rains. Engineers can do nothing with a deformed steel sleeper, and from facing points at one end to facing points at the other of single line railway stations in India, flat-footed rails should be laid on wooden sleepers. Most derailments occur on points and crossings. The deformed sleepers can with difficulty be got out, and it is impossible to interpose new steel sleepers without tampering with the jaws, whilst a wooden sleeper can be easily slipped in. This objection would not stand if the width of the foot of the rail were less than the distance between the jaws.

Trial is about to be made in India of a steel sleeper wide enough between the jaws to receive the rail, and, in addition to the key driven outside, a distance piece inside, which will allow of much finer modification of gage, as well as of the easy interposition of sleepers where required, without disturbing the whole rail length or altering the jaws. This sleeper, moreover, will not only render alteration of the jaws unnecessary, but will practically prevent it by a buckled or corrugated abutment. The only objection, so far as can be seen, is that the sleeper will consist of five parts, having two distance pieces fitted inside as well as two keys driven outside. Some engineers are of opinion that the wider jaws can be adopted with a broader key only, but there would be a greater tendency to strain the outer jaw and tilt inwards.

That steel sleepers do not lend themselves readily to use with double or bull-headed rails must be granted. Their proper use is with a flat-footed rail in a soil that is not moist and brackish. They are then easily laid, hold well in gage, are cheaply maintained, and durable. The average life of rails and sleepers is frequently recorded without any details as to soil, hygrometric or other atmospheric conditions, loads, speeds, curves, grades, etc.; and no practical deductions can possibly be made from such statistics. The arithmetical calculations may be fairly accurate, but a steel sleeper road laid in a few miles of wet saline soil will completely spoil the average. It is known that wooden sleepers are rapidly spoiled by white ants in certain districts, and steel sleepers are rapidly rusted in others; that cedar from the Himalayas, creosoted pine from Europe, and steel or cast-iron sleepers from England, meet in cost at certain points on Indian railways; that any attempt to fix an artificial price on indigenous wood can be foiled by a recourse to imported metal; that the longer life of metal sleepers under well-known conditions will compensate their greater cost; that the fastenings required with each description of sleeper have also to be taken into account; and that wood and cast-iron scrap have a varying value in different parts of the country. As scrap, unserviceable steel sleepers have little or no value in India, while cast-iron scrap is eagerly bought.

Electric Underground Railroads in Paris and Buda Pests.

Foreign advices concerning the Berlier electric underground railroad project at Paris continue to give assurance of the early beginning of the actual work of construction. The tunnel is to run in almost a straight line from the Bois de Vincennes to the Bois de Boulogne, and is to be driven by the use of a cylindrical shield. It is to be an iron tube about 21 ft. in diameter, and is to contain two lines of track. It is the intention to conduct the excavation without interfering in any way with the street traffic on the surface, and to this end lateral tunnels are to lead from the main tunnel to the banks of the Seine, and through these the material is to be carried away.

The stations, of which there are to be 17, are to be reached from the street surface by elevators and spiral stairways, the latter winding around the elevator shafts, and the exits into the streets are to be through attractively designed kiosks on the sidewalks, except in the very heart of the city, where sidewalk space will not be available, and where, therefore, the exits will have to be provided for in adjoining houses.

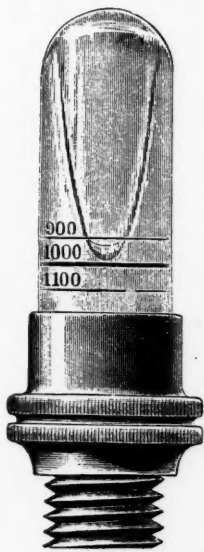
It may not be amiss to repeat here that the electric current will be supplied through a central rail, of square section, which is to rest on glass insulating blocks. A voltage of 500 is to be employed, and the trains are to be made up of four cars, each capable of seating 52 passengers. The inclusive speed is to be about 12 miles an hour, and the trip from one end of the line to the other—a distance of about $6\frac{1}{2}$ miles—is to take $37\frac{1}{2}$ minutes, including the station stops. The cars are to have side doors. Provision is to be made for ventilation by air shafts. There will probably be a uniform fare of 20 centimes. The road is to be ready for service in 1898.

Somewhat different in plan, though designed for the same purpose, will be the underground road which is to be built at Budapest. There the tunnel will be immediately below the street surface, and the entire street will be closed to traffic during construction. Simultaneously with the building up of the side walls and the laying down of the floor, iron pillars will be erected at intervals of about 13 feet along the center line of the tunnel, for the support of longitudinal and cross girders, between which Monier system, béton arches will be sprung. These will complete the tunnel work proper. On top of the arches will be spread a layer of béton, then a layer of asphalt, and, finally, another layer of béton. On top of this will be laid the wood paving in common use at Budapest. The line will be double track, and the station platforms will be about 75 feet long, affording ample room for two cars to pull up and take on and let off passengers. The cars, of course, will be propelled electrically, and the current will be supplied through mains carried along the tunnel walls.

One of the unique features of the line will be the practically automatic character of the service. When the cars approach one of the stations the motors will be automatically thrown out of circuit and the brakes applied, and as soon as the train stops the car doors will open themselves, and the brakes will be released. With the closing of the last car door the motors will be again put in circuit, and the train will proceed. The line will be divided up into blocks about 328 ft. long, and each train, as it reaches a block on which there is still another train, will have its motors cut out and brakes set. April 1, 1896, has been put down as the date of opening of the road.

Braun's Speed Recorder.

The illustration shows a speed recorder, invented by a



Dr. Braun, and called the gyrometer. It consists of a cylindrical glass tube, which is partly filled with a transparent liquid such as glycerine. The horizontal lines are marked with figures which give the number of revolutions per minute. When motionless the glycerine has a level surface; while when being turned around a vertical axis, the centrifugal force drives the glycerine upward. For each velocity there is one state of equilibrium which is indicated by the shape of the glycerine surface. It is read on the scale which is empirically found. The gyrometer is very sensitive, and recorded at an official test up to 400 variations of speed per minute, with an accuracy of $\frac{1}{3}$ of 1 per cent.

The instrument is used largely for centrifugal machines, and is to be tried for locomotives.

Indictments for the Atchison Rebates.

The officers of the Atchison, Topeka & Santa Fe, who were indicted by the Grand Jury at Chicago, Oct. 19, for alleged illegal rate manipulation, have given bail as follows: W. J. Jenkins, \$5,000; J. A. Kanley, J. W. Reinhart and Nelson Morris, \$10,000 each, and Isaac Thompson, \$5,000. Mr. Jenkins is General Manager for G. H. Hammond & Co., and Isaac Thompson is a large cattle buyer and shipper of Kansas City.

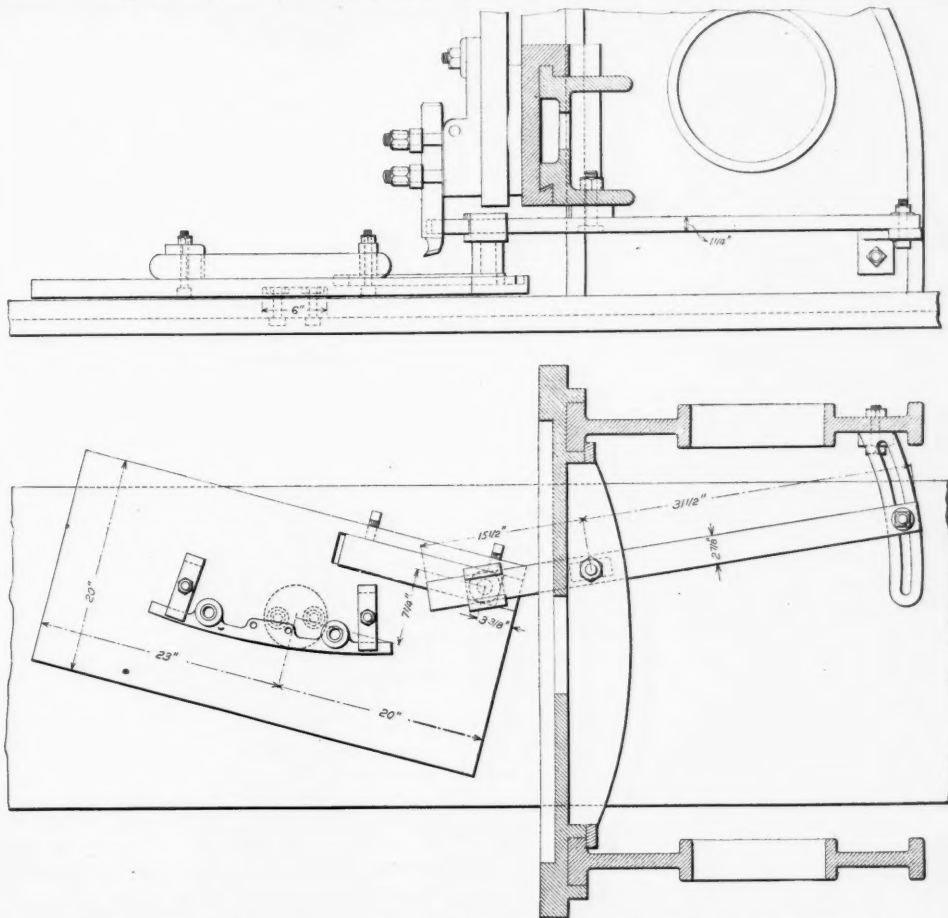
The indictment against Messrs. Reinhart and Hanley contains two counts. The first charges that from April 1 to November 1, 1892, they, being agents of the Atchison Company, received from Thompson sundry shipments of cattle, amounting to 178 cars, from Kansas City to Chicago, which were charged for and paid at the tariff rate, but that on October 15, 1892, the road paid Thompson a rebate of \$5 a car. The second count charges that from February 1 to October 1, 1892, the defendants received from G. H. Hammond & Co., 596 car loads of cattle for shipment from Kansas City to Hammond, Ind., on which a rebate of \$5 per car was paid to W. P. Jenkins, an agent of Hammond.

The indictment against Morris is for receiving rebates, and aiding and abetting violations of the law, etc., amounting to \$16.60 per car on 1,200 cars of cattle shipped over the Atchison from March 1 to December 1, 1892, at a special rate of \$40 per car, being \$16.60 less than legal tariff.

A Device for Planing Locomotive Links and Quadrants.

The accompanying illustration shows the construction of a simple and convenient device for planing locomotive links and quadrants used in the Chicago shops of the Chicago & Northwestern Railway Co.

The work to be planed is clamped on a table as indicated, the table being secured to the bed of an ordinary planer in such a way that it can be moved horizontally about a point near its center. Its movement is controlled by a bar fastened diagonally across the bed and secured to the frame of the planer. At the corner of the table is a short, vertical post, the upper end of which is fitted to receive the diagonal bar, and by means of which the



Arrangement for Planing Locomotive Links and Quadrants—Chicago & North Western Ry.

table is caused to revolve about its fixed point when the planer bed is moved. By varying the angle of the bar the angular motion of the table may be so regulated that the radius of the curve to which the tool works can be made long or short, as desired. The device has been in use for several years on links and quadrants, and has given entire satisfaction.

Electric Lighting of Railroad Trains.

With reference to the paper on this subject by Mr. M. B. Leonard, which was published in the *Railroad Gazette* of July 27th and Aug. 3d last, Mr. T. Ireland, Telegraph Superintendent of the Great Northern of England (which company, alone, with the London, Brighton & South Coast now maintains electric car lighting in this country) has favored me with the following practical criticisms on the various systems there described.

With regard to Mr. Geo. Gibbs' "direct current" system (the first noted by Mr. Leonard) Mr. Ireland considers the one drawback mentioned to be a serious one, viz.: that the lighting by electricity ceases when the cars containing the engine and dynamo are shifted to or from the train. Moreover, in the summer time, when the locomotive has to be depended upon for steam for the electric light engine, the electric light cannot be maintained when the engine is detached, as will doubtless be the case frequently. The proposal to remedy this by using small storage batteries to supply a few lamps of low voltage in each car is not, in Mr. Ireland's opinion, a good one. It would be better to provide batteries of sufficient capacity to maintain the average light for a considerable time, so that each carriage might be to some extent independent of the generating plant. Mr. Ireland does not see that Mr. Gibbs' method has any advantages over the Great Northern system of driving the dynamo from one axle of one of the vehicles, but so far as the cost of the two systems can be compared, there is not much difference.

The only difference between Mr. Gibbs' system and that of the Pullman Palace Car Co., next mentioned, is that the latter includes storage batteries. In this respect

Mr. Ireland is of the opinion that the Pullman Co.'s system is superior and that the advantage of maintaining the light when the motor car is detached is worth the additional expense of installation. With regard to the two other systems mentioned, Mr. Ireland continues as follows:

"The system of lighting by storage battery alone and charging at terminal points recommends itself by its simplicity, and would no doubt answer very well if the vehicles containing the batteries could be spared from running long enough for charging operations; but the removal of the batteries from and to the cars, before and after charging, is, I have found from experience, very objectionable, owing to the trouble and expense involved. The figures showing the cost per lamp-hour prove that charging *in situ* is more economical.

"The Lewis system of driving from the axle is, in principle and in many details, very similar to the methods in use on the Brighton and the Great Northern. A separate dynamo for each car is doubtless advantageous in some respects, but the expense must necessarily be great for installation, and the maintenance

would, I think, be found costly if the system were applied to any great extent.

"I am also of the opinion that it would be impracticable to keep the dynamos in working order if attached to the bolsters and beams under the vehicles, as suggested, as experience has proved that ready access to the dynamos, as well as to the accumulators or storage batteries is an indispensable condition for good working in any system of electric lighting. With regard to the differential, compound winding of the field coils of the dynamo this idea was conceived on the Great Northern some years ago, but such a method was found to be unnecessary, as with accumulators of sufficient capacity, the variation of the electro-motive force of the dynamo with the speed can be compensated for in a much more simple way. It is believed that the effect of the increased current in the armature upon the weakened field in the Lewis method would cause excessive sparking and it would be interesting to know how this is avoided.

"The centrifugal governor for connecting the accumulators with the field coils has been in use on the Brighton for many years. The form of pole changer described appears to be novel, but somewhat complicated, being actuated electrically. The same object is achieved mechanically on the Brighton and the Great Northern in a very simple manner. The automatic cut-in-switch described is similar in principle to the one in use on the Great Northern, though somewhat different in detail."

C. H. G.

LONDON, Oct. 5, 1894.

The Congo Railroad.

About 60 kilometers, or 37 miles, of the Congo Railroad has now been constructed after five years' work. The road starts from Matadi on the Congo River below the falls and climbs out of the gorge by the M'pozio Valley, reaching a height of 1,200 ft. in about 20 miles. At Kengé, 25 miles, and 845 ft. above the sea, there are a large station and shops. The work to this place has been heavy and there are 26 bridges, varying in length from 15 to 210 ft. The total expenditure has been 18,360, 272 francs, of which about 12 per cent. is put down to interest on capital.



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EDITORIAL ANNOUNCEMENTS.

Contributions.—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contract for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to ALL DEPARTMENTS of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.

Advertisements.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. We give in our editorial columns OUR OWN opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.

A certain large railroad has saved during the past year enough to pay a small dividend, by economizing in what are usually called small details. This statement was recently made on good authority, and we asked an officer of the road to tell us *what* these details were; concrete facts make mighty interesting reading in such a case. He will not do this, but his answer is worth reading, nevertheless, and we print it in this issue, headed: "The Day of Small Things." While the article consists mostly of generalities it must be remembered that it is from a man who has applied these to particulars and found that the process paid. It sometimes seems as though the railroad era in this country might be divided into two periods; the first when the roads were small and could manage details economically, but did not need to, because they were rich; the second when they are in pressing need of every cent that can be saved, but are so big that it is impossible to watch the leaks. The success of our correspondent may be said to be due to the adaptation to a large institution of methods which are well-known and familiar in smaller ones.

The "Protective Committee" appointed by certain minority stockholders of the Atchison, Topeka & Santa Fé, last July, made a strong fight at the annual meeting in Topeka last week to get a representation on the Board of Directors, and it is barely possible that they will succeed. A restraining order was secured from Judge Foster of the United States District Court which had the effect of postponing the election until a decision could be rendered on the demand of the Protective Committee that the election should be held under the law of Kansas, which permits cumulative voting. Under this plan the minority can mass their votes for their own candidates and thus make sure of the election of, they say, three members. They claim to be able to vote 200,000 shares. As we go to press Judge Foster has not rendered his final decision, but it is stated in press despatches that he will grant the demand of those stockholders who reside in Kansas, but will decide against those who live in other states. If this is so, the move made by the Committee will be fruitless, as the number of shares owned in Kansas is very small. The principal point made by the present Board is that the charter of the road was granted before the cumulative voting law was passed. It is claimed on the other hand, however, that the company has accepted legislation passed since it was chartered, and that the scope of the original charter has been widened by this and other acts. The attempt to take advantage of this law has been made before, but without success.

The Protective Committee appears to be composed of good men, and their aim in this matter is laudable, but it is not entirely clear that they ought to succeed. It is said that the men whom they wish to get elected to the Board are Theodore W. Myers, formerly Controller of the city of New York, Benjamin F. Tracy and Henry Clews. These are conservative men and no one doubts that they would strive to promote the best interests of the stockholders, but at best they would go into the Board under the conditions that usually hamper a minority whose sole reason for existence is to keep up a contest. The chief grievance

of the minority is that no clear statement of the condition of the road has been given to the stockholders. This is true and the demand should be satisfied, but it is not unfair to assume that the present Board will do this as soon as it can be done with due regard to all interests. The minority complain because the present directors were selected by the old directors who retired under public condemnation. This is true, but, after all, each individual director is responsible for his own action and the present members of the Board are, most of them, of high standing, and it is at least premature to suspect that they will internationally do anything to the detriment of the property. The new members are: John A. McCall, of the New York Life Insurance Company, Thomas P. Fowler, President of the New York, Ontario & Western; F. K. Sturgis, of Work, Strong & Co.; William L. Bull, James A. Blair, E. J. Berwynd, General S. C. Lawrence, a director in the Boston & Maine, and B. P. Cheney, Jr. The last two are Boston men, and Mr. Cheney is the son of one of the oldest and the largest stockholders in the road. He is talked of by the majority for president and has the confidence of all classes.

The Puzzles of Rate-Making.

The intricacy of the principles of making and the constant difficulty of adjusting rates so that they shall be ideally just to all parties, are well illustrated in two documents lately published. One is the answer of the Louisville & Nashville in the suit of the Cincinnati Freight Bureau to compel the road to reduce rates from Cincinnati to southern cities, as ordered by the Interstate Commerce Commission; the other is the answer of the Northern Pacific and the Great Northern to an order of the Railroad Commissioners of North Dakota requiring those roads to reduce their rates on coal.

The principal points presented by the Louisville & Nashville are that shippers were satisfied with the old rates and that the proposed change would cause the road a loss of \$100,000 a year. The main point in the Dakota case is that the roads do not earn enough to pay the interest on their cost and the rates must be raised on grain or something else if coal rates are reduced. These arguments are sound, but they are not to be accepted as conclusive, until the evidence supporting them is set forth and compared with that presented against the railroads; and we do not purpose attempting to forestall the action of the courts, but it may be worth while to examine the arguments for a moment merely in the way of a "study" in rate making.

The points in the argument are numerous. Lawyers are noted for adducing innumerable reasons why their client should not be made to suffer; but while as a rule nine-tenths of such reasons may be nothing but sawdust, when it comes to freight rate-making, in a country grid-ironed with railroads, this rule does not hold good; there the lawyer who sets out to "stump" the judge or jury does not have to rake up whimsical arguments, for he has enough good ones. Any one who thinks rate-making is simple work can learn a good deal from the two cases we refer to.

The first point made by the Louisville & Nashville is that it was not properly impleaded, as the Interstate Commerce Commission is not a court. It is also claimed that the road has a right to demand that the case shall be tried by a jury. It is claimed that the Interstate Commerce Commission has no power to fix rates. Probably all these pleas have strength. As every one knows the Commission law was intended to be modeled after the English and the Massachusetts laws under which the Commissions adjusted rates as related to one another, but did not make them. But when a critical case comes up it is found that this is like taking levels without a datum; our work is all in the air. The final adjustment involves a fight if the losing party chooses to defend himself. Of course the Commission is not a court. Every one knows this, but many people seem to forget it. And the Louisville & Nashville case well illustrates one of the unavoidable inconveniences, often costly, of the present law. The appeal to the courts necessitated taking most of the evidence over again. Probably the Cincinnati merchants will hereafter be strong advocates of the proposed amendment, giving the evidence gathered by the Commission a better standing in court. Under proper rules such evidence ought to be received the same as that of a master in chancery.

The Commission makes a mistake, says the counsel of the road, when it adjusts rates over the Louisville & Nashville (from Chicago) by those from New York, which have to be reduced to compete with the low water rates southward from New York along the Atlantic Coast. This is the pith of the defense. We shall not attempt to discuss it; but it is obvious that no hu-

man being is competent to fairly consider all the elements in a comparison of the claims of Chicago and New York when they are competing for the sale of a box of soap in Alabama. It will be remembered that the Commission ordered the reduction largely because the roads sixteen years ago had avowedly raised rates to favor New York. They deserved punishment for continuing that basis after 1887, even if the Chicago rates were now fair and the New York rates too low!

Next it is shown that the cost per ton per mile is not a just measure of the reasonableness of rates. Here again the Commission was treading on insecure ground. The average cost per ton is so affected by the kind of freight that a road hauls most of, that this argument is probably no whit better than to take the granger's original and all-embracing claim: you are making too much money and we propose to have you make less.

"In reducing rates from Cincinnati and Chicago the Commission gives these cities an unfair advantage over Newport, Covington, Lexington, Louisville, St. Louis, Memphis, Nashville and several other cities; these ought to have been given a hearing." Thus far we have been in deep water which is measurably familiar. This point simply takes us farther out where it is deeper. The claim of these cities is just as real if not as tangible, as that of Chicago or Cincinnati. "By fixing rates to Knoxville, Atlanta and other prominent cities, the relations between them are injured." Probably the lawyers added this claim, chiefly to reinforce the others. It is not likely that evidence to give it definite support can be clearly presented so to have much effect, and yet traffic managers have to deal with such claims every day, made by sincere people, and often have to recognize them in making rates.

"In naming rates to a number of cities and requiring the road to go on and follow out the same rule in making tariffs for other cities, not named, the Commission asks an impossibility." This is largely a technical claim, probably; for if the road were to follow the rule as well as possible the Commission would be satisfied; but the plea is a reminder that in making rates every road has to deviate from the "rule" constantly. The only rule that can be consistently followed is to adjust yourself to circumstances whenever they can not be adjusted to you.

"The defendant is a member of the Southern Railway & Steamship Association and cannot force the other roads to join it in making the changes required by the Commission." A court can readily brush this aside if it sees fit, of course; but as the value of rate-regulating associations is now generally recognized, more or less fully, this is one more legitimate obstacle in the way of the Commission. Finally, the rates adjudged excessive were in effect many years prior to Dec. 26, 1891, and were not complained of, and the proposed reduction will involve a loss to the road of \$100,000 a year. Probably the sum named is a vague estimate, but it is the most definite point yet presented on either side, and it will be interesting to hear it argued.

The answers of the Northern Pacific and the Great Northern are not so long as that mentioned above, but they present equally hard nuts to crack. The Great Northern earns only \$127 net per mile per year. This is a hard fact and its hardness will have to be admitted even by the farmer who feels sure that the road ought to favor him. A road in such a thin country must struggle for life, at best; and it is bound to put forth its best endeavors not to go into insolvency before its customers do.

A reduction on coal rates would necessitate raising the rate on grain, and it is claimed that the present arrangement of rates distributes the burden of the cost of transportation fairly among the farmers and the dwellers in towns. From the newspaper abstract it would seem that the road claims that it is better for the community that the road should make its profit on coal than on grain. Very likely this is true. Coal is a necessity and the freight bill is paid quite directly by the consumer. Grain, on the other hand, is more subject to caprices of market rates, and a very low temporary freight rate, or comparatively frequent changes, might be of much more advantage to the people of North Dakota than a reduction on coal. At any rate, it would seem to be a better field for making re-adjustments than the coal tariff.

Comparison having been made with rates in Kansas the railroads show that in North Dakota many more cars have to be hauled west empty. Furthermore, the population per square mile in Kansas, and other states to the south, is 32, while in Minnesota, North Dakota and South Dakota it is but 7.8. This last point will probably not be appreciated by the average shipper, but yet it often makes as much difference to railroads as a difference of a quarter of a dollar a bushel on wheat does to the farmer. A statement is given showing that the older states mentioned furnish

much more freight to the square mile, 105 tons of wheat and corn, as compared with 23 tons in Minnesota and Dakota.

Finally the roads offer as a clincher that the Central of New Jersey, the Reading and the Lehigh Valley carry over seven millions of tons of coal a year and yet do not make any lower rates per mile than does the Great Northern. On this we will give the Commissioners a "pointer;" these Eastern roads charge too much.

The substance of all these bewildering arguments, is what the wisest students have long since told us, that the work of rate-making is so complex that to do it fairly by force of law is out of the question. We are as likely to work injustice as the opposite. We have the seeming paradox that railroads resist with all their might an order from the government to reduce their rates and perhaps the next day reduce them voluntarily. But it cannot be assumed that responsible managers, with millions of property at stake, would do this wantonly, and it would seem therefore that the theory of charging what the traffic will bear and of discriminating in some cases, where no one suffers from the discrimination, ought to be looked upon with some respect, even by those who hate it.

Variation in Temperature in Locomotive Cylinders.

Locomotives as they are used to-day are what are known as high-pressure engines and the variation of the pressure, and therefore of the temperature, in the cylinders is too great for good economy. The most efficient steam engines are those wherein the variation of pressure in each cylinder has been greatly reduced so that it seldom exceeds 70 pounds and is more frequently about 50 pounds. In a locomotive it is common now to find a variation of 180 and in some cases 200 pounds. It is not the variation of pressure in itself that is prejudicial to economy, it is the variation in temperature that is incidental to the variation in pressure. The higher the pressure of steam the higher its temperature. Fig. 1, shows how the temperature varies with the pressure; it is seen that the temperature curve rises more slowly for the higher pressures and more rapidly for the lower pressures. Steam enters the cylinders at a high temperature and leaves it at a lower temperature. In an engine carrying 200 pounds pressure, the entering steam has a temperature of 388 degrees F., while the exhaust steam has a temperature of about 212 degrees. The difference between these temperatures is 176 degrees, or twice the difference between a hot day in summer and a cold day in winter in this climate. It requires some thought to appreciate how cold the steam is going out relatively to that coming into a single expansion locomotive cylinder, and to understand why it is that it pays to make steam engines for marine work so much more complicated as they are with compound, triple and quadruple expansion cylinders and their attendant valve mechanisms. If the walls of the cylinders were of the same temperature as the outgoing steam, when the incoming steam strikes them, the engine would be practically powerless, as the steam would condense instantly, in fact the cylinders would be very efficient condensers, but the walls of the cylinders soon get heated up, not to the temperature of the incoming steam, but to about the average temperature of the cylinder. This average is not the average during the length of the stroke as might be measured from an indicator card, as that is an average temperature based on a given distance, but it is the average with respect to time, and to determine this it is necessary to change considerably the horizontal scale of indicator cards, as commonly taken, in order to show directly by the curves of the card the pressure and temperatures with respect to time. This has been done for six indicator cards and is given in what follows.

Prof. Tyndal, in one of his popular lectures on science, was perhaps the first to bring to the attention of engineers generally the important fact that steam and water vapor take in and give out heat with remarkable rapidity. This action, while not instantaneous in fact, yet is so for all practical purposes of discussion of engines running at anything like the speed common with steam engines. Take a condensing engine running at 300 revolutions; if the condenser is a large one, and properly arranged, the exhaust steam, although entering 600 times a minute, or every one-tenth of a second, is condensed with such rapidity that the indicator cards show a vacuum immediately after the exhaust is open. Another curious fact is that the steam can hardly be said to be condensed by contact with the cold surface of the condenser, but rather by radiation of heat from the steam to the surface of the condenser. Steam, like other bodies, may be cooled in two ways, namely, by contact and by radiation. The radiation goes on in

direct line, just as light travels and the interposition of a shield shuts off the transfer of heat by radiation just as light is shut off by a screen. In some forms of condensers it is probably true that a considerable portion of the steam is condensed by contact, where the heat is given up by conduction. The relative amount of the heat given out by conduction and radiation is dependent upon the arrangement of the surface of the condenser with respect to the entering steam.

For similar reasons the steam in a cylinder is not condensed by contact solely, but by radiation as well, and in most cases probably much of the condensation is the direct result of radiation of the heat from the steam to the relatively colder surfaces of the piston, passages and cylinder barrel. When the passages are long and narrow it may be that conduction is a more important factor than radiation, but the relative amounts of heat transferred in the two ways has not been studied enough to make it known what the comparative condensation is. For all practical purposes, however, it is enough to know that the steam is condensed and the efficiency of the engine reduced when the difference between the temperature of the walls and surfaces of the passages, piston and cylinder and the temperature of the incoming steam is increased. For the same reason when the differences in these temperatures are reduced, the efficiency is increased and this is one reason why a better economy is expected from compound locomotives, although the principal part of the increased efficiency results no doubt from the more complete expansion that is obtained.

As an example of the wide variation of the temperature of locomotive cylinders, we have taken six indicator cards with rather high initial pressures, and which represent the action of steam in locomotive cylinders under average conditions, except perhaps in the matter of back pressure which in these cards is much too high to give good economy and does not represent good practice nor common practice. But for the purpose of illustrating graphically the changes in temperature of the steam within a locomotive cylinder, perhaps these cards are even more useful than more correct ones, as they show more variation of temperature during the return stroke and thus make a more forcible illustration.

These cards, Nos. 1 to 6, fig. 2, were taken from a freight locomotive. The maximum boiler pressure was 180 pounds, the cylinder 20x24 inches, drivers 51 inches in diameter. The mean effective pressures are given on the cards. There is a noticeable loss between the boiler pressure and the initial pressure in some of the cards, especially Nos. 1, 2, and 3. This is due to a small throttle opening.

From these indicator cards have been constructed the temperature cards, fig. 3. These cards have numbers corresponding with those in fig. 2, the figures at the side of these diagrams represent the temperatures in Fahrenheit degrees, while the horizontal distances represent parts of the stroke of the piston the same as in fig. 2. These diagrams have been shifted so that the right-hand diagram does not coincide exactly with the left. This has been done as a matter of convenience to assist in measuring the temperatures in cylinders. The distance between the ends of the cards, say between A and B, card 1, fig. 3, is the same as the width of the packing in the piston. The cards being placed in this way, it is found that the temperature of the steam on one side of the edge F of the packing, say at C, fig. 4, is that at C card 1, fig. 3, while on the opposite side of the edge of the packing ring at D, fig. 4, the temperature is that given at D card 1, fig. 3, where the vertical line CD crosses the card from the opposite end of the cylinder. The piston is supposed to be moving in the direction of the arrow, fig. 4, and the temperature at D is taken as that of the steam in the cylinder when the point D on the cylinder passed under the edge of the packing ring E. The temperature of the steam to which any point is exposed is taken as constant while the packing is passing over. The width of the packing is taken at three inches and is the same as the distance from A to B on card 1, fig. 3. It is for these reasons that the temperature cards of fig. 3 have been drawn apart the distance from A to B.

The temperature cards, fig. 3, give the temperature at different points in the cylinder, but different parts of the surface of the cylinder are exposed for different lengths of time to the temperatures shown on the diagrams. Take for instance the points G and H. At G, card 3, fig. 3, the piston is moving but slowly compared to its velocity at the point H, hence more time is required to traverse a unit of length. It is necessary in order to show how long the steam is exposed to the different temperatures to lay out the temperatures on a scale that represents uniform time. This has been

done by taking the time of one-half revolution instead of the length of the stroke as a basis. Fig. 5 explains this. From I to J represents the stroke and in traversing this distance the velocity of the piston is variable, but in moving from I to K the crank velocity is uniform and the time to travel from I to L is represented by the length of the arc IK, and for this reason the point K on card No. 1, fig. 6, is not located from I, the distance IL, but instead is taken the distance IK, fig. 5, which properly represents the time. So then the diagram of the actual variation in temperature given in figs. 6 to 11 inclusive show not only the variation in temperature to which the different points of the cylinder are exposed, but also the comparative lengths of time during which this exposure takes place. Practically then the curved lines on these diagrams indicate the total range of temperature of the surface with respect to time, and the average height of the curved lines gives the mean temperature of the steam at the different points of the cylinder during a revolution. The dotted lines give the mean temperatures during a revolution. This is important to know as the difference between the average or mean temperature of the cylinder and the temperature of the incoming steam is the basis from which the condensation up to cut-off must be calculated, for it is generally assumed that the walls of the cylinder, including the passages at each point, will have a temperature corresponding to the average temperature of the steam, to which it is exposed. A calculation for one revolution may be taken for all revolutions as they are duplicates of each other in steady running engines, where the cut-off and the initial pressure remain practically the same. When the cut-off or the initial pressure is changed the average temperature of the steam is also changed as will be seen from these diagrams.

Figs. 6 to 11 inclusive show the variations in temperature and the average temperature of several points in the cylinder up to and including half stroke. These points include the surfaces of the ports, cylinder heads and piston, which are given by the diagram marked "clearance," and the first, second, third, fourth and eighth-inch points of the stroke and mid stroke or the twelve-inch point.

Referring now to fig. 6, it will be seen that the different diagrams shown give the following information: The clearance diagram has in all cases the exact temperature of the indicator cards at different points, and the only reason why these diagrams differ from the temperature diagrams, fig. 3, in form is that the horizontal distances represent time which is uniformly spaced in fig. 6, while in the case of fig. 3 the horizontal distances represent parts of the stroke over which the piston passes with a varying speed and therefore does not describe equal spaces in equal times. Another way of saying this is that the temperature on the diagrams figs. 6 to 11, are plotted on a time basis, while those of fig. 3 are plotted on a distance basis. Referring to the "clearance temperature diagram," fig. 6, the temperature at the beginning of the stroke is that given at M, and as the piston moves away from the end of the stroke the succeeding temperatures are given by the height of the upper curve passing from M to the end of the stroke at N, as shown by the arrows. On the return stroke the temperatures are shown by the lower curve from N to O, as indicated by the arrows at the bottom of the diagram. The same is true of all the other diagrams, but those taken outside of the clearance space are more complicated in shape. In all cases M represents one end of the stroke and N the other, and the direction of the arrows indicates the curve to be followed in passing from M to N.

The diagram for the first inch, fig. 6, shows the following: The first inch point of the cylinder is never exposed to steam at the opposite end of the cylinder, as the packing is 3 inches wide and does not pass over so as to expose the first inch to the opposite end. The temperature M to P for the first and second inch diagrams, fig. 6, will remain constant and at the temperature given at the points P P, diagram 1, Fig. 3, until the piston has passed over those points and exposed them to the incoming steam, which has a temperature Q Q. After this time the temperature of the first and second inch points is identical with the temperature diagrams for the clearance, as is evident from a comparison of the diagrams. The diagram for the third inch is peculiar, in as much as its distance from the end of the stroke is the same as the width of the packing. The diagrams for all succeeding points up to one-half stroke are of the form shown by those for the fourth and eighth inch, which may be explained as follows: When the piston is at the end of the stroke, at M, the fourth inch has a temperature corresponding to the temperature at the end of the stroke on the opposite end of the cylinder, as at R, dia-

gram 1, fig. 3, and as the piston moves away from the end of the stroke, the temperature falls until at the point *S* of diagram 1, fig. 3, the packing ring covers the fourth inch and the temperature from *T* to *U*, fig. 6, corresponds with that at *S*, card 1, fig. 3; that is, it is constant while the packing ring is passing over. At *U*, the packing ring having passed, the fourth inch is immediately exposed to the live steam entering the cylinder, therefore the diagram rises to *V*, and thereafter the line of temperatures follows the clearance diagram until the packing ring again passes over the fourth inch, as at *W*; then the temperature remains constant while the packing ring is passing by; that is, until the point *X* is reached; then this point is immediately exposed to steam at the

opposite end of the cylinder; therefore the diagram rises to *Y* and then follows the temperature of the expanding and exhausting steam at the opposite end of the cylinder or from *Y* to *R*, diagram 1, fig. 3.

One point more of interest remains to be considered, viz., the effect of increasing the number of revolutions per minute and changing the cut-off. The change in cut-off affects the shape of the diagrams considerably, as is seen from a comparison of figs. 6 and 11, but the length of the diagrams, which are noticeably shorter for the higher speeds, depends entirely upon the time required to make a single revolution, these cards being laid out on a time basis, as before explained.

A common card for passenger engines in ordinary service, and for freight engines, is that shown by fig. 11, and the wide variation in temperature to which the different parts of the cylinder are exposed is striking and instructive. It is noticeable that the widest variation is for the surfaces of the piston, piston head and passages as given in the diagram marked "clearance," while the least variation is found at points near the center of the cylinder. The extreme variation in the case of indicator card No. 6, fig. 2, in the clearance space, is 143 degrees, while in the center of the cylinder it is but 80 degrees. These diagrams are all drawn to the same scale and reduced in the same ratio, hence, as here shown, the illustrations may be compared with each other.

Cards taken from compound locomotives would not show such a wide variation in temperature; in fact, they should not show more than half this variation and the important effect which compounding may have on cylinder condensation is indicated by this fact, but it must be remembered that the saving in cylinder condensation, while it is the most important advantage obtained from compounding in stationary and marine engines, where simple engines are commonly run at the most

economical points of cut-off, yet in locomotives where the cut-off is generally too long, the most important advantage of the compound engine is a greater expansion of the steam. Great care must be taken in

These diagrams are based on saturated steam, that is, steam that is not superheated, which is the state in which steam is used in locomotives and engines generally. For superheated steam indicator diagrams do

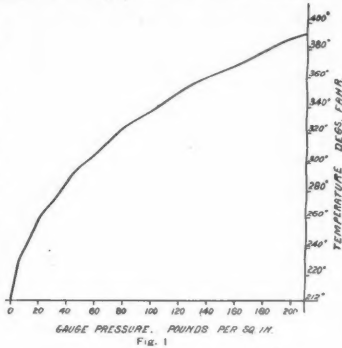


Fig. 1. Variation of the temperature and pressure of steam.

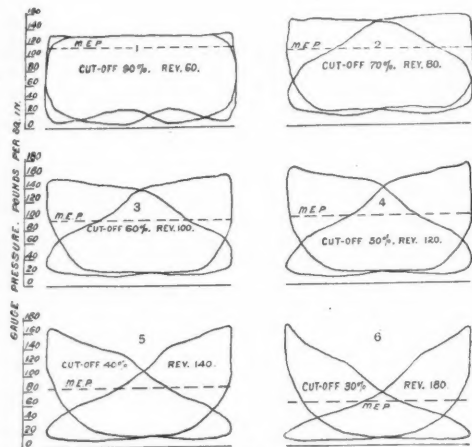


Fig. 2. Indicator cards taken from a Freight Locomotive, 180 lbs. Boiler pressure.

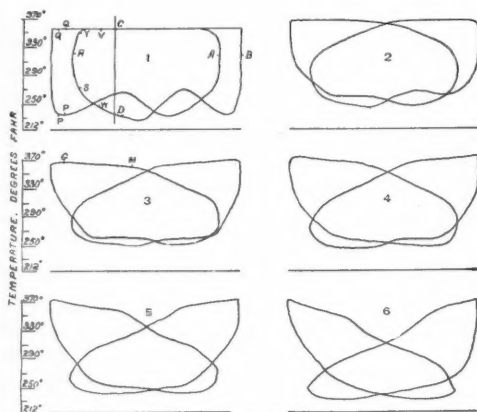


Fig. 3. Temperature cards taken from Fig. 2.

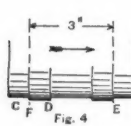


Fig. 4. Piston Packing.

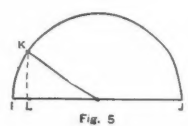


Fig. 5. Comparison of a time and distance basis.

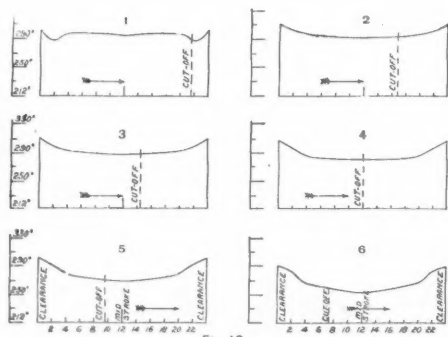


Fig. 6. Mean temperature to which different parts of cylinder are exposed.

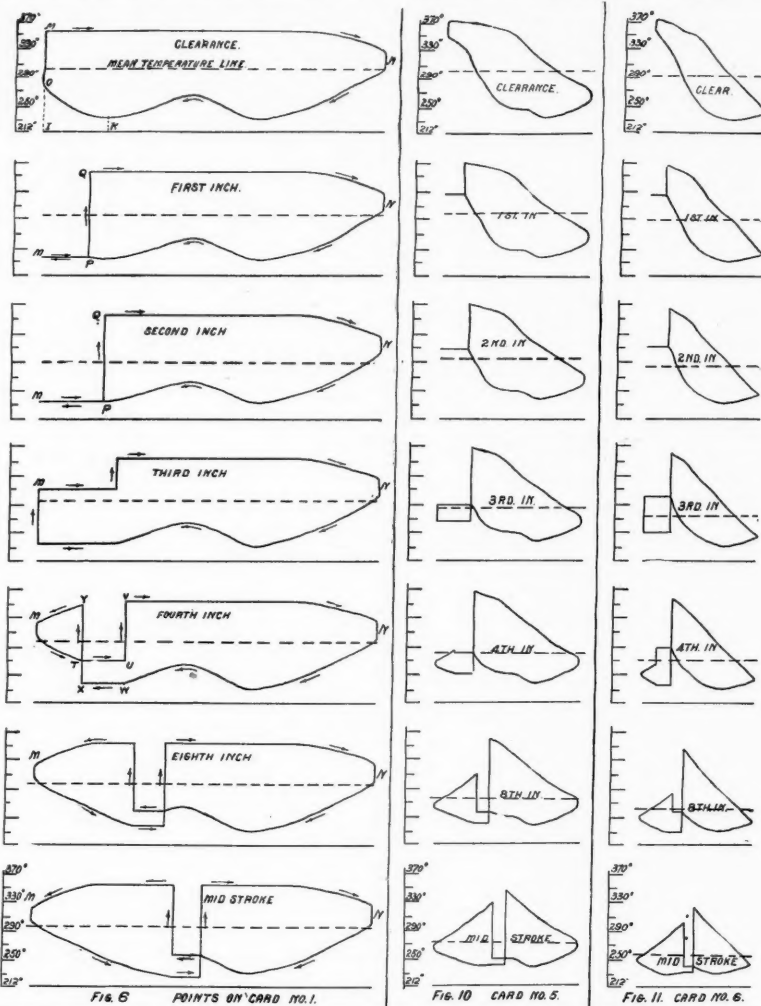


Fig. 7. POINTS ON CARD NO. 1.

Fig. 10. CARD NO. 5.

Fig. 11. CARD NO. 6.

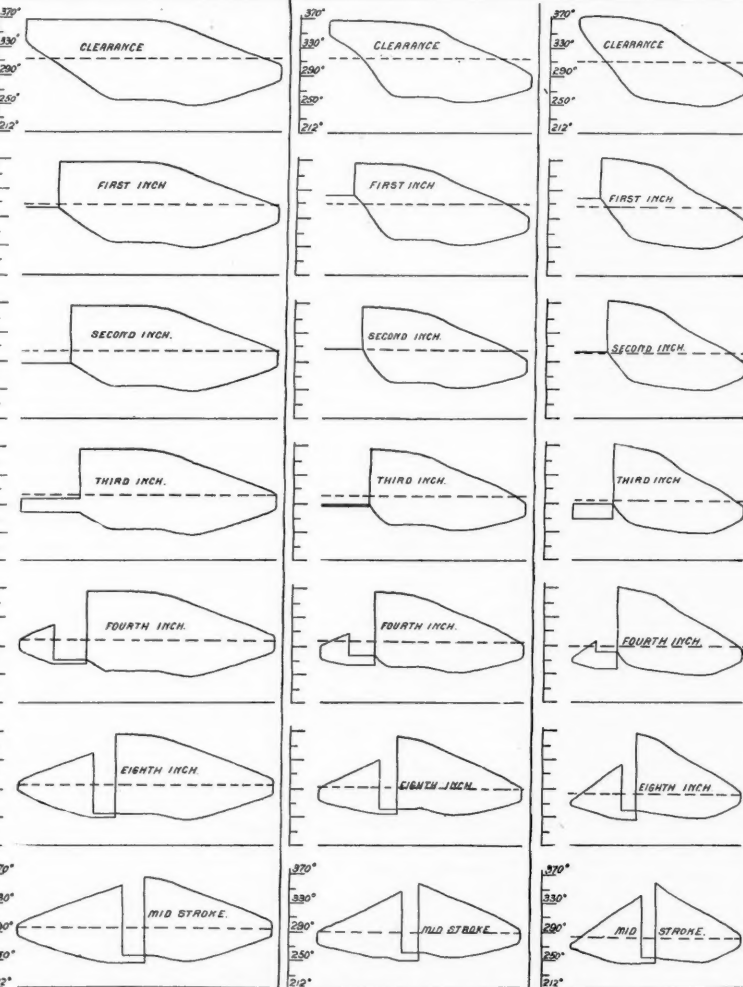


Fig. 8. POINTS ON CARD NO. 2.

Fig. 9. CARD NO. 3.

Fig. 10. CARD NO. 4.

Diagrams with Article on Variation of Temperature in Locomotive Cylinders.

insulating or covering the larger hot surfaces of compound locomotive cylinders especially in cold weather, if there is to be any saving whatsoever in cylinder condensation as the result of compounding.

not show directly the temperature of the steam, as there is no fixed relation between the temperature and pressure of superheated steam as is the case with saturated steam.

Fig. 12 is perhaps the most interesting of all the diagrams, as it shows the different mean temperatures to which the different parts of the cylinder are exposed and in making calculations of the cylinder condensation this diagram must be made and carefully examined so that the extent of the surface which is exposed, to the different temperatures may be taken into account. For instance, the area of the surface which is exposed to the variations of temperature shown by the clearance diagram, is vastly greater than the area exposed to the variation of temperature represented by the mid-stroke diagram, especially in locomotive cylinders where the passages leading to the cylinders are long and narrow. In making an estimate of the cylinder condensation it is accurate enough for all practical purposes to take each individual inch of length of the cylinder surface and estimate the condensation for any given temperature of entering steam, assuming the mean temperature of the cylinder surface, that is, the cast iron barrel, to be the temperature corresponding with that given on the diagrams fig. 12, but of course these diagrams have to be constructed from the indicator cards taken from the engine in question. The diagrams here given apply only to the engine from which they were taken. Each inch of length of the cylinder barrel has the same area exposed; in the case of this engine it is 63 square inches. The area exposed to the temperature of the "clearance" diagram is about 1,232 square inches; thus appears the necessity for considering the condensation on the different surfaces of the cylinder independently. Owing to the preponderance of the area of the clearance spaces, in some classes of engines, that surface alone is sometimes considered in making calculations for cylinder condensation. It is probably near enough for all practical purposes in most cases to estimate the condensation in the clearance spaces, using the clearance area and assuming the temperature of the walls of the clearance space to be that given by the diagram like fig. 12, and add to this the condensation that would take place on the area of the barrel of the cylinder up to cut-off, taking the temperature of that surface as the mean of the diagram fig. 12 up to the point of cut-off.

It has not been the object in presenting this analysis to outline a plan for calculating cylinder condensation, as that requires more explanation and careful examination than has been indicated here, but it has been the purpose to show the wide variation in temperature to which the walls of a locomotive cylinder are exposed and in a general way to outline some of the reasons why in some cases as much as 30 and 40 per cent. of the steam entering locomotive cylinders is condensed without doing useful work and is therefore lost.

The Flying Machine Harnessed.

We have received within a few days a copy of a pamphlet entitled "The Coming Railroad, the Chase-Kirchner Aerodromic System of Transportation," which is issued from room No. 401 Odd Fellows' Building, St. Louis, Mo. We are thus particular because we wish to help anybody who wants the pamphlet to get it. We have a dim notion that this document came into our hands some months ago, but unfortunately fell into the waste basket. Therefore, we propose to say what we have to say on the subject at once, lest a similar accident happen to the second copy.

The object of the gentlemen who have printed the pamphlet is to call the attention of the world to a sort of semi-flying machine for which they have chosen a serious name. As usual with people who start out to revolutionize the transportation system of the world, they show, through several pages, what a colossal industry that is, and what serious evils infest it; and they tell us that "railroad securities are already being declined as investments by shrewd, level-headed men for the avowed reason that they foresee the coming of a new system of transportation, which will compete directly and successfully with the present railroads for the carrying trade." So far as we remember this is the first time that we have heard of this reason for the fall in price of railroad securities. We have heard it attributed to the Interstate Commerce Law, to the Populists, to Debs, to the Democrats, to grasshoppers, to Governor Larrabee and to droughts, but never before to aerodromics, and we are grateful to Mr. Chase and Mr. Kirchner for having at last called attention to the real trouble. We suppose that they have been reluctant to do so, because they foresaw the personal peril to which they would be exposed. Naturally there are thousands and thousands of widows and orphans in the United States who have now a direct and powerful motive to kill Mr. Chase and Mr. Kirchner. For a number of months these poor people have been hungry. Now they know who has taken the bread out of their mouths, and we would recommend the gentlemen who have committed this awful deed to skip over the border.

But what is the Aerodromic System? We have called it the flying machine harnessed. Briefly, it is proposed to build an elevated railroad, and the authors of the system kindly tell us that the columns which support this

road are firmly fastened to stone or concrete foundations and are thoroughly braced, and that the spans may be varied in length to suit the requirements of the terrain. They tell us also that for crossing deep ravines, and the like, "steel cables may be used, supported in such a manner that the line of the car's progress will be practically rectilinear, or a continuous tangent to the resulting catenary." Dear, dear, what fine language they have, with their terrains and their catenaries! Those words should sell lots of stock. We learn also that the vehicles which are to run on this elevated railroad will be of different lengths, and that they will be fire-proof, and heated and lighted by electricity. We do not learn, however, what is to be done with the enterprising road agent who shins up a column and flags an aerodromic car. Probably he will be shocked. The car is to be suspended from the top rail of the elevated structure and guided by wheels running on or against the lower rail. Of course it is to be pointed and to have a free run aft in order to lessen air resistance; that goes without saying in any modern scheme of high speed railroading. It will be remembered that even the Frenchmen have begun to put noses on their locomotives in order to cut the air. This pointed car is to be propelled by electricity, and we are told that the motors will be of a type yet to be chosen. Dr. Wellington Adams, it will be remembered, got beyond this point; he chose his type.

But now we come to the great idea. Anybody could put a plow on a car and taper it fore and aft and run it by electricity on an elevated track; but it remained for the authors of the Aerodromic System to harness the flying machine, and we suspect that Maxim stole his idea from them. At any rate, carried above the car by a suitable frame "substantially as set forth" are to be certain banks of aeroplanes, hinged and so arranged that their inclination to the horizontal can be easily changed. Now the great art in navigating the car is to change this angle so as to just lift the weight off the track, leaving on the drivers only what is absolutely necessary for adhesion. In going uphill for instance the car will simply soar and no additional power will be required. If, however, the operator is disappointed, and finds that the driving wheels really have a little more work to do, he can ease her off a bit and get more adhesion.

We shall not follow the authors further, but the reader can understand that this great idea has many ramifications. In fact, the more one thinks about it the more it ramifies, and if prices were not so low we should be disposed to sell all of our railroad securities now.

Just about 13 years have passed since the Association of Engineering Societies was organized. In those 13 years the Association has grown from four societies to eight. The societies which formed the Association were those of Boston, Chicago, Cleveland and St. Louis. Since that time the Engineers' Clubs of Kansas City and Minneapolis, the Montana Society and the Engineers' Society of St. Paul, have joined, and during the 13 years the Association has continued to publish its monthly *Journal*, which, with various ups and downs of merit, has had more ups than downs; and the mean curve would show not only an increase in the number of pages of matter published, but probably in the scientific value per page, although that is a matter rather more difficult to estimate. At any rate, the Association has done an extremely important work, and one which could not have been done in any other way. It has not only simplified the matter of publishing the reports, papers and discussions of the various local engineering clubs, but has in many cases made such publication possible where otherwise it would have been impossible. It has also brought about a coherence in feeling and action in the great body of engineers of the United States which did not exist before; for the local societies contain in their ranks not only members of the four great societies which have headquarters at New York, but many men who are members of neither of those societies. There could be no doubt, we should suppose, of the wholesome influence of the Association on the profession. The Secretary has recently issued, by the order of the Board of Managers, a circular letter addressed to a number of clubs and societies which are still outside of the Association, setting forth some of the advantages of joining it. In this letter he points out that the publication of society papers can be made through the Association with considerable economy; that all members get in the *Journal* the papers not only of their own society, but of all the other societies, and that they get in addition the very valuable index to current literature. Provision is made also for separate publication of the papers and proceedings of each society if that is wished; that is, any desired number of reprints of any paper or papers will be made before the type of the *Journal* is distributed, and at designated intervals these reprints can be bound and furnished for the society wishing them at a great deal less cost than they could be had for by independent publication. The Association furnishes also to such societies as wish advance copies of papers for discussion, and thus accomplishes a valuable end which would be impossible in most of the small societies working independently. The societies to whom the circular is addressed are invited to appoint delegates to confer with the Board of Managers as to joining the Association.

The annual report of the British Board of Trade on Interlocking and Block Signaling has just been issued for the year 1893. The double track railroads of the United

Kingdom may now be said to be wholly operated on the block system. The percentage stated in the report is 99.6 (Dec. 31, 1892, it was 99.2), but the small percentage not blocked consists of very short pieces in station yards on the majority of which the traffic is doubtless conducted under regulations which provide a high degree of safety. The statistics of interlocking may be summarized as follows:

	Dec. 31, 1893.	Dec. 31, 1892.
Number of switches or crossings in passenger lines.....	42,057	41,356
Number of cases where switch and signal levers are concentrated.....	41,179	39,829
Not concentrated.....	878	1,527
Number of cases where signal levers and switch levers are interlocked.....	41,309	40,000
Not interlocked.....	748	1,356
Proportion interlocked, per cent.....	98	97
Safety points on side tracks.....	25,87	24,829
Side tracks not thus provided.....	773	1,062

While the number of switches, crossings, etc., has increased it appears that some of the larger companies in rearranging stations and adding main tracks have reduced the number of crossovers and siding connections. An appendix to the report gives statements from some of the companies showing the new work which was in hand or proposed at the time the report was made. The Great Western reports about 160 stations at which interlocking was put in in 1893 or was proposed for 1894.

The through passenger route between New York and San Francisco, via New Orleans, is now claimed to be the quickest between the two cities, and the claim comes pretty near being a good one. The new Sunset Limited of the Southern Pacific, which leaves New Orleans every Thursday morning at 8 o'clock, makes close connection with the Southwestern vestibule limited of the Southern Railway, which runs from New York to New Orleans in 40 hours. The length of this schedule between New York and San Francisco is, therefore, 117 hours. The distance is 3,858 miles, making the rate of speed about 33 miles an hour including all stops. But a passenger can go through by the direct line, any day in the week, in 116½ hours, as we reckon it, and have six hours to stop over in Chicago. The 25-hour train of the New York Central, leaving New York Monday afternoon at 4.30, connects at Chicago with the Chicago & Northwestern train which starts at 10.30 p. m. on Tuesday and reaches San Francisco at 9.45 a. m. on Saturday (or 12.45 p. m. Eastern time). The distance is 3,333 miles, or 525 less than via New Orleans.

NEW PUBLICATIONS.

Transactions of the Association of Engineers of Cornell University. Volume 2, 1893-94: A publication containing addresses delivered and papers read before the Association during the school year. Published by the Association, Ithaca, N. Y.

This volume contains a paper by Clemens Herschel, C. E., on the II Books of Frontinus on the Water Supply of the City of Rome. In this address Mr. Herschel has given a historical sketch of Rome's water supply and its construction. The subject is scientifically treated and it is a valuable and interesting contribution to engineering literature. The Transactions contain a paper by Mr. John F. Hayford, C. E., which gives an instructive description of Certain Field Methods employed by the author on the Survey of the Mexican Boundary in 1892-93. The paper describes in detail the latitude and the azimuth determinations, the methods used in tracing long straight lines, and the use of heliotropes under abnormal conditions. The paper is very well prepared for instruction of students, containing, as it does, the records of observation and the computations adopted to reach practical results. Another address contained is entitled *Some Notes on Fire Protection Engineering*, by John R. Freeman, C. E., of Boston, which affords considerable information not found in the books. The paper contains many illustrations and is devoted chiefly to the fireproof construction of factories and mills.

The Transactions are lacking in one requisite feature of a publication, in that they contain no table of contents or index.

Tables of Diameters, Areas, Weights, etc., of Tubes.—By O. J. Edwards, Heed Building, Philadelphia. Price, 50 cents.

This is a pamphlet of five tables, giving certain data for tubes having external diameters varying by sixteenths, from ½ up to 2¼ inches. These diameters being the column headings, the internal diameter is given in decimals of an inch for various gages from 28 to 3; so of areas, external and internal, areas of cross-section and weights in pounds per foot and in pounds per inch. The tables will of course be useful, if accurate. In the copy that we have received we observe that the decimal for ⅝ of an inch is incorrectly given in the headings of all the tables, but we are assured that the quantities in all the tables have been used constantly for three years and are undoubtedly accurate.

Gas Refrigeration for Cars.

It is reported that carbonic acid gas is soon to be tried as a substitute for ice in refrigerator cars in the California fruit trade. Instead of the usual construction for refrigerator cars the car with which the experiment is to be tried is said to be an ordinary box car lined with zinc so as to be practically air tight. It is to be filled with fruit, and gas introduced, a condenser filled with the liquefied gas furnishing the required supply.

TRADE CATALOGUES

The Trident Water Meter.—We have received lately, at various times, a set of little pamphlets issued by the Neptune Meter Co., of New York (29 Broadway) telling in general and in detail certain interesting facts about the Trident water meter. The pamphlets are so clearly written and with such sound knowledge of physical laws and of mechanical practice that they are excellent scientific reading even for a man who is not interested in water meters. The first one describes the Trident meter as a whole, showing the working parts in detail. Another one is a little essay on "Disk Action," explaining the principal causes of the breaking of disk pistons of disk water meters. On this matter Mr. Thomson, the engineer, and presumably the author of the pamphlets, is almost the ultimate authority, if not quite, and he received at the Paris Exposition of 1889 the highest prize, a silver medal, for his inventions in disk water meters; the meter exhibited there by his company having been the first of the type commercially introduced.

Another pamphlet is entitled "On Ice," and it gives us a compact essay on the physics of ice, and applies the knowledge there revealed to the construction of the Trident meter, which is so devised and made that if it does freeze the minimum of damage will result. That is, the cap which holds in place the disk case is held by threads which are weakened by cutting away the base and also by cutting across them transversely; thus if the meter is frozen the cap threads will strip and the disk casing will be forced out without injury. The disk casing is in two sections held together by a snap joint, so that in freezing no vital part of that will be broken. The disk casing also is tapering outside and hence is free the instant it starts out. Another pamphlet concerns Oscillating Disk Action, and explains why any other disk than the Trident will hammer itself to pieces in rapid service. Still another called "Compound Action" shows on the cover a train of spur gearing on which the devil is dancing, armed with the Trident of Mr. Thomson's company. This pamphlet explains in detail the virtues of the system of gearing used in this meter; and while it is admitted that it is possible to find some faults in any human contrivance the company frankly owns that it "knows that the Trident is king."

Cutters.—The Brown & Sharpe Manufacturing Co., of Providence, R. I., issues a special pamphlet on cutters which is handsomely illustrated. Many complicated forms of special cutters are shown, evidently by half-tone engravings from photographs. Most of the illustrations are selected to show the facilities of the company to make special work of this sort, and the illustrations are generally nearly full size. The concern now makes 19 varieties and 849 sizes of stock cutters, and can make any size or shape, or arrange for any desired combination. The pamphlet will be sent to any person interested, on application to the company.

The Detroit Dry Dock Company, Detroit, Mich., has recently issued a pamphlet entitled, "A Tale of the Smoke Stack of a Modern Lake Steamer," giving a description of the Howden Hot Draft System as applied to marine boilers. This is by no means a new system of supplying heated air to boiler furnaces, as it may be said to have passed its experimental stage some eight or ten years since, and is now quite extensively used on ocean going steamships, among which are some of the vessels of the White Star, Cunard, Allan, and American lines. The system was first applied on the lakes to the steel passenger boat Virginia, described in the *Railroad Gazette*, but is now in use on eight or ten of the better class of lake steamers, including the Chicora, City of Mackinac and Harvey H. Brown.

In another pamphlet, issued by the same company, there is given a detailed account of tests made in July last on the Harvey H. Brown by Geo. C. Shepard, Cleveland, O. The supply of air to the furnaces is maintained by means of a fan 4 ft. 6 in. in diameter, driven by a small pair of engines. A trunk leads from this fan to the front of the boilers and delivers air to a large box in the boiler breeching, the box being placed just above the upper row of tubes and containing 412, 3-in. tubes, 4 ft. 6 in. long, through which the gases pass on their way to the stack. The air passes through this box and is conducted to valves through which it is admitted above and below the grates. The fire and ash pit doors are air tight, and before opening the fire door for any purpose the valves admitting air beneath the grates are closed. From the results of these tests the fact has been deduced that freight can be moved at a speed of 12.65 miles per hour, with an expenditure of 0.77 of an ounce of coal per ton-mile. Or with coal at \$2.25 per ton, a ton of freight can be moved 184 miles at an expenditure of one cent. The Detroit Dry Dock Company is the sole agents for the system on the lakes.

TECHNICAL.

Manufacturing and Business.

The Westinghouse Air-Brake Company's works at Wilmerding, Pa., which have been working only seven hours a day and four days a week for many months, in addition to laying off a large number of men, have resumed operations to their full capacity.

The "S. S. Curry," the largest steamship on the

Lakes, has a capacity of 4,500 tons of coal, and was recently unloaded in one day at Gladstone, Mich., by means of the C. W. Hunt Company's coal handling machinery.

The formal opening of the plant of the Whiteley Malleable Castings Co., of Muncie, Ind., occurred on Tuesday, Oct. 30. The entire plant embraces about 12 acres and the buildings contain about four acres of floor space. The shops are equipped with the latest improved machinery and are operated exclusively by natural gas and electrical equipment. The many guests were entertained by the company at the Kirby House.

The Youngstown Bridge Co., of Youngstown, O., has the contract for eight spans of bridge girders for the Cleveland, Lorain & Wheeling, and the contract for buildings for the Beaver Tin Plate Co., of New Lisbon, O., consisting of the mill building, 100 ft. x 200 ft., and the annealing house and boiler house. The company has also been awarded the contract for the Junction avenue bridge for the Lake Shore & Michigan Southern, at Toledo, O.; the Bayou Natchez bridge at Natchitoches, La.; and a building for the Jeannette Bottle Works, at Jeannette, Pa.

The Cleveland Twist Drill Co. sends a transcript of the award made to that company for its exhibit at the World's Fair, the wording being as follows: "Most extensive exhibit and greatest variety of well made twist drills, exhibited as they are manufactured and furnished to the trade. The workmanship on all of these drills is of the highest order, and especially meritorious are the twist drills in millimeter diameters."

The Schultz Bridge & Iron Co., has the contract for erecting all the buildings of an extensive tin plate manufacturing plant to be built by Goldsmith, Lowenberg & Co., of New York City, at New Kensington, near Pittsburgh. A member of the firm states that the cost of the plant will probably be over \$300,000, and it will have a capacity for 60 tons of tin plate daily.

Iron and Steel.

Watkin R. Edwards, who for a number of years was superintendent of engineers and machinists at the Edgar Thomson Steel Works, has resigned his position to become master mechanic of the plant of the Ohio Steel Company, of Youngstown, O.

The Carnegie Steel Co., has come into possession of ten acres of ground in Duquesne, Pa. The company will commence immediately the erection of four great blast furnaces.

New Stations and Shops.

The Baltimore & Ohio has begun work on new car shops on Eighth street, in Zanesville, O. The new plant will be used for general repair work, and it will have capacity sufficient to employ 200 men.

The new Union Passenger Station, at Kenova, W. Va., for the use of the Norfolk & Western, Chesapeake & Ohio, and Huntington & Big Sandy (Ohio River) is completed. The building cost \$50,000, and it is the finest station and office building in West Virginia. The tracks of one road are on a level with the first story, and the others are on a higher level.

The plans of the Pennsylvania Co., operating the Pittsburgh, Wheeling & Kentucky Railroad, with regard to the new station at Wheeling, W. V., have been changed, and the new building will be put up at once. It was the intention to postpone the work until spring, but the amicable settlement of litigation with property owners has made an immediate beginning possible. The stone retaining wall on the Ohio River side is about completed. The building alone is to cost \$50,000.

The new power station for the Nassau Electric Railway Co., at Brooklyn, N. Y., will be 102 ft. x 150 ft., and will be constructed entirely of iron and steel, the whole designed and built by the Berlin Iron Bridge Co. The roof will be covered with that company's patent anti-condensation corrugated iron roof covering. Randolph & Clowes, of Waterbury, Conn., have placed the contract for the extension to their muffle room with the Berlin Iron Bridge Co.

Chicago Bridges.

The Chicago city authorities have been notified by Captain W. L. Marshall, of the United States Engineers, that the abutments for the new bridge at Van Buren street encroach upon the channel beyond the limits authorized by the Secretary of War. The permit provided for a draw of 100 ft. in the clear in a straight line with the river. It is now found that the passage is considerably less, as piles have been driven around the abutments to act as fenders, thus taking up several feet on each side. Between the piles the draw is but 92 ft. from side to side. The draw pier has not been made parallel with the river, but at right angles with the street, thus further reducing the actual opening to about 80 ft.

This bridge, as has before been noted in the *Railroad Gazette*, is to be of the rocking, bascule type, similar to that of the Metropolitan Elevated, which is now being erected a short distance to the north of the city bridge. It is reported that the abutments of the bridge of the elevated railroad also encroach upon the channel to a greater extent than allowed by the permit from the War Department and will have to be changed.

Lighting the Brooklyn Bridge Cars.

A special meeting of the Trustees of the New York & Brooklyn Bridge was held Oct. 25 to dispose of the contract for lighting the Bridge cars by electricity. Three bids were received, one from the Electrical & Mechanical

Engineering & Trading Co., and two from the General Electric Co. As the latter bids were not accompanied by checks they were not considered and the contract was awarded to the Electrical & Mechanical Co. The company will receive \$18,135 for the installation of plant and equipment, and guarantees that the cost of operation (exclusive of steam and labor) and of maintenance shall not exceed \$1,300 a year.

The specifications call for the equipment of 60 cars, each with ten 16-candle power lamps. The maximum number of trains moving at one time is 12 of 4 cars each, requiring, consequently, 480 lamps to be lighted at once. The contractors are required to furnish an entire and complete system of electric lighting, including structures, machines and parts, in place and ready for operation, except the power-house with its foundations and piping; these will be supplied by the Trustees. The generating plant must consist of two engines, each capable of developing not less than 40-horse power at 300 revolutions. The dynamos are to be two, each of 25 k. w., wound for 250 volts at 300 revolutions. The trolley system to be installed must cover the main tracks over the bridge, the switches at the New York station, also those at the Brooklyn station which are used in switching the trains from one main track to the other. The track rails are to be properly bonded and the two rails of one track and the corresponding trolley wires must be cross bonded at intervals of not less than 500 ft. The rail bonds must be capable of carrying back the return circuit with a resistance less than that overcome on the outgoing circuit, and should the conductivity of the rails not be sufficient for the return circuit an insulated track feeder or main must be installed leading back to the switchboard. The lights must be ready for operation in 90 days.

THE SCRAP HEAP.

A Colombian Railroad Concession for Sale.

American railroad projectors and contractors have an opportunity to secure a concession granted by the Department of Cundinamarca in the Republic of Colombia for the building of a narrow gauge railroad to connect the city of Bogota with the southern end of the Sabana or plateau. The length of the proposed road is 21 miles and will serve a population estimated at 235,000 people. The climate is healthy, the temperature about 55 degrees on an average, but never exceeding 72 degrees. The Department has granted exclusive privilege to operate the road between these points for 30 years; after this period has elapsed competing roads can be built. Both the land for the road bed and for the stations are furnished by the Department without charge, and there is a subvention of \$5,000 per kilometer from the Government. It is estimated that the cost of construction and equipment of the road would not exceed \$300,000, and local contractors have agreed to contract for the work for that sum. The gross income of the road once in operation is estimated at \$120,000, less operating and other expenses, \$45,000; net earnings, \$65,000 a year, or more than 20 per cent. on the estimated cost. The extreme southern end of this road is at the point where the Bogota River precipitates itself into the valleys leading to the Magdalena River and forms the Tequendarna cataract; following the banks of this river this railroad could be prolonged to meet the Girardot railroad now in course of construction, and the Magdalena Valley. There are abundant coal mines in the neighborhood, and also plenty of timber suitable for use in the construction of the road. The surveys are all made. The road may be run either by steam or electricity, and for the latter the Tequendarna fall furnishes extra abundant power which might be utilized for other purposes. Maps and profiles of the road can be seen at the office of Camacho, Roldan & Van Sickle, 95 Broad street, New York.

Contractors' Suit Against City of Milwaukee.

Schailer & Schniglaw, a firm of Chicago engineers and contractors, have commenced suit against the City of Milwaukee for damages on account of the abrogation of a contract which the firm had for work on an intake tunnel. During a heavy storm some time since a crib was washed away and 14 men were drowned, whereupon the city declared the contract nullified. The contractors claim a heavy loss by reason of the action of the city.

The Trolley in Spain.

Even in Spain the electric trolley has worked its way into favor. The street car lines at Madrid are soon to be operated by it, after the plans of the General Electric Co., of Berlin, Germany.

Cheap Method of Breaking Up Old Freight Cars.

One of the liveliest places in East Buffalo nowadays is in the north yard of the New York Central, where the old cars are broken up. The road weeds out its old cars periodically, and instead of taking the trouble of breaking up the cars and burning the wood, the cars are placed on side tracks and the Poles in the neighborhood are invited to help themselves to the wood, with the provision that none of the iron shall be taken. Yesterday morning nearly 100 cars were placed on the tracks, and by evening there was left a mass of trucks and iron that will go back to the shop for use in other cars. People of all sizes, sex and conditions were busy all through the day with saws, hammers and axes in laying away firewood for the winter. Much of the timber was carted away in wagons and wheel-barrows, while those not fortunate enough to own a conveyance, carried it on their backs. When darkness fell upon the scene last evening there was hardly enough timber left of the cars to make a fair-sized bonfire. —*Buffalo Express.*

CAR BUILDING.

The Terre Haute Car Mfg. Co. is running its works with about 50 per cent. of its usual force. It is building 150 cars for the Vandalia, and a large amount of repair work.

The Ohio Falls Car Mfg. Co. has all departments in operation, employing about two-thirds the usual force.

The Mount Vernon Car Works, of Mount Vernon, Ill., have the contract for repairing 500 freight cars for the Louisville, Evansville & St. Louis.

The Wagner Palace Car Works, at East Buffalo, N. Y., is working on full time with 400 men. The only new work in hand is two vestibuled coaches for the Lehigh Valley.

BRIDGE BUILDING.

Catlettsburg, Ky.—The new bridge building by the Chesapeake & Ohio Railroad, over the Big Sandy River, from West Virginia to Kentucky, at Catlettsburg, Ky., to take the place of an old bridge, was practically completed Nov. 1, and will be in use by the middle of the month, if the approaches can be filled in by that time. The bridge is a substantial structure, built to carry a heavy double track traffic. The company proposes to double track the line from Huntington, W. Va., to Ashland, Ky.

Green County, Ala.—The County Commissioners of Greene and Pickens counties have appropriated \$900, and the citizens of the two counties have given \$600 more for the purpose of building a \$1,500 iron bridge across the Sipsey River.

Glenwood, Pa.—Work has been commenced on the bridge at Glenwood across the Monongahela River. It will have a center span of 520 ft., two spans of 300 ft. each, with viaduct approach at each end, and is adapted to street railroad and highway traffic. The contractor is Samuel P. White and the superstructure is being built by the Penn Bridge Co., of Beaver Falls, Pa., and the substructure by Messrs. Jutte & Foley, of Pittsburgh.

Marinette, Wis.—A new iron bridge will be built over the Menominee River at Marinette this winter.

Scranton, Pa.—The ordinance providing for the construction of a viaduct on West Lackawanna avenue, over the main track sand switches of the Delaware, Lackawanna & Western, and appropriating money for the payment of the city's share of the cost of constructing the same, passed Common Council last week. It details the fact that the Scranton Traction Co., and the railroad company have each agreed to pay one-third of the cost of the viaduct, that is, \$10,000 each, the city to pay \$10,000; the total cost assumed to be \$30,000. The project has been under consideration for nearly a year and has been before Councils since last April.

Syracuse, N. Y.—The city authorities of Syracuse want a new lift bridge built over the Erie Canal at Salina street, to be similar in construction with the recently built Clinton street bridge. The Wrought Iron Bridge Co. has submitted plans for this structure, but Mayor Amos, of Syracuse, has asked State Engineer Adams to have the plans prepared in his office. Half the cost of the structure, if built, will be borne by the State, and the other half by the city of Syracuse. It is thought that the structure will cost about \$20,000.

Philadelphia.—The proposed new bridge across the Schuylkill River at Grey's Ferry, Philadelphia, has again come up for animated discussion. The plans for the structure are now being prepared by the City Bureau of Surveys, and there is said to be some possibility that the work will be started this year. The project was before the City Council last spring, and its authority for carrying on the work will undoubtedly be readily secured. The bridge will have two stories, the tracks of the Pennsylvania Railroad crossing on the lower level, the roadway being carried above. The estimated cost is \$800,000, and the city and the railroad company will apportion the cost between them.

RAILROAD LAW—NOTES OF DECISIONS.

Carriage of Goods and Injuries to Property.

In the Federal Court it is said that the common-law rule forbidding common carriers from exacting unreasonable charges does not apply to interstate commerce, though the contract of carriage is made in a State where that rule prevails, since such commerce is governed solely by the laws of the United States, and the United States has never adopted the common law.¹

The Supreme Court of the United States rules that the granting of a rebate contrary to the provision of the interstate commerce law does not render the bill of lading void, so that no action can be maintained against the carrier for loss of the goods by negligence.²

In California it is held that though two days before a carrier accepted goods for shipment over its own and connecting lines a snowstorm commenced on a connecting line a thousand miles away, it will not be presumed to have known that an unusual storm had set in, of which it was bound to speak as a fact liable to cause delay, where severe storms in that latitude were up to that time unknown, and the road might reasonably be expected to be open when the goods reached it.³

In Arkansas it is held that one seeking to charge a railroad with negligence in allowing infected cattle to stray from a wrecked train has the burden to show that the railroad had notice that the cattle were infected.⁴

In Texas it is ruled that as a railroad company's station agent is ordinarily its agent to make contracts for the shipment of stock, the burden is on the company, when it seeks to limit his authority, to show, not only that the authority did not exist, but that such fact was known to the shipper.⁵

In turn it is held that the statute making a railroad liable for damages from fire, does not give the public such an interest in the company's exercise of care with respect to buildings which it has permitted a person to erect on its right of way grounds as to render void, as against public policy, a contract exempting the company from liability for damages by fire negligently communicated to the buildings by the company's engines.⁶

The Supreme Court of Kansas holds that a shipper cannot enjoin the Board of Railroad Commissioners from promulgating and putting in force a new and reduced schedule of rates for car-load shipments, on the ground that this will, in effect, discriminate against him and others who have occasion to ship goods in quantities less than a car load.⁷

Injuries to Passengers, Employes and Strangers.

In New York it is held that the boarding by a person of an elevated railroad train while the gate is closing and the train moving, and persisting, against an effort to remove him, in the precarious position thus obtained, is such contributory negligence as bars recovery for his death in consequence thereof.⁸

In Utah it is held that where a person, believing he has a right to do so, rides on a freight train with the consent of the conductor in charge, and, while so riding, is injured through the negligence of the trainmen, the company is liable to him as a passenger, though such train be one which, by the rules of the company, was not allowed to carry passengers.⁹

In Texas, plaintiff, a passenger alighting from defendant's train on its regular depot platform, stepped from the last step of the car onto a railroad spike. The head of the spike had a thin, sharp edge, which injured the ball of plaintiff's foot. The Supreme Court rules that defendant was liable for the injury.¹⁰

In Texas it is held that a train must be stopped at a station long enough to allow passengers to alight safely,

and, if not, and they are carried past, the train should, if necessary, be backed; and in the case of a woman traveling with four children, all less than six years old, it was negligence to set them down six hundred yards beyond the station, in a wet place, at 5 a. m., in cold winter weather.¹¹

In Kentucky it is held that a railroad which receives foreign cars for transportation over its road is charged with the duty of making a careful superficial inspection, such as an ordinarily prudent man engaged in such business would make, for the protection of the employes required to handle the cars; and when the defects are patent, and an injury occurs to an employe through such a defect, of which he is ignorant, the company is responsible.¹²

In Pennsylvania it is ruled that where a railroad gives an employe general authority, actual or apparent, to act for it in the capacity of a detective officer, and such authority includes, expressly or by general usage and consent, the power to make an arrest in its behalf, it will be liable for a wrongful arrest made by him without a warrant, though it does not expressly authorize an arrest without a warrant.¹³

In Michigan it is held that though a railroad engineer violates an express rule by running his engine from one station to another without orders from the train dispatcher, he is still acting within the line of his employment, and the company will be liable to a passenger for an injury caused by such misconduct.¹⁴

In Georgia it is ruled that the incompetency of a fireman to properly run a locomotive will not make the railroad company liable for a personal injury resulting therefrom to another employe, who, knowing of the inexperience of the fireman, made no objection to serving with him.¹⁵

In West Virginia it is held that where a brakeman knows of a rule of the company requiring him to examine all brakes before using them, and, if out of order, either to fix them or report the defect, and also knows that a nut used to hold a brake wheel on the standard was off, but, without putting it in proper condition or reporting it, unnecessarily uses the brake, and is injured, he cannot recover.¹⁶

In New York, after several ineffectual efforts by defendant's trainmen to switch cars to the proper point for unloading at the elevator of a third person, plaintiff, an employe of such third person, whose duty was to receive and unload cars, offered to place them himself, and while so engaged was injured by the negligence of the trainmen. The Supreme Court rules that the plaintiff did not thereby become the fellow servant of the man in charge of the train.¹⁷

In Kansas it is held that where a railroad company buys from a reliable dealer a lifting jack with a latent defect, consisting of a defective weld of the foot, and, after using it, sends it into its shop to repair broken cogs, if it was or ought to have been the practice at the shop to examine all tools sent in for repairs, to discover any other defects, and a reasonable examination by the iron workers would have disclosed the defective weld, the company was negligent in sending out the jack with the defect.¹⁸

In Missouri it is held where a division roadmaster directs that the brake staffs be removed from a number of flat cars, and the brakes being thus rendered useless, orders the cars to be loaded with steel rails, and left standing near a steep grade on a side track, from which they escape, and, running rapidly down the grade, collide with an approaching train, and kill its engineer, the roadmaster is negligent, and the company is liable.¹⁹

In Kentucky it is held that a servant who stands upon an unrailed platform two feet wide, and attempts to pry a pulley off with a piece of scantling, assumes the risk of the scantling breaking and causing him to fall.²⁰

In Michigan, plaintiff, a fireman in defendant's employ, while in the cab of his engine, was struck by a limb of a tree on a platform car in a passing freight train. A rule of defendant, known to plaintiff, made it the duty of freight conductors to examine all platform cars to see that they were safely loaded, and the conductor of the freight train testified that he examined the car containing the trees, and found it properly loaded. The evidence showed that the conductor was a competent man, that defendant furnished safe appliances to the shipper for loading the car, and that the cab in which plaintiff worked was a safe one. The Supreme Court rules that plaintiff could not recover, as the negligence, if any, was that of the conductor, plaintiff's fellow servant, in failing to properly inspect the car.²¹

- ¹ Swift v. Phila. & R. 58 Fed. Rep. 838.
- ² Merchants' Cotton-Press v. Ins. Co. 14 S. Ct. 367.
- ³ Palmer v. A. P. & S. F. 35 Pac. Rep. 630.
- ⁴ St. L. I. M. & S. v. Goolsby, 24 S. W. Rep. 1,071.
- ⁵ G. C. & S. F. v. Hume, 24 S. W. Rep. 915.
- ⁶ Griswold v. Ill. Cent. 57 N. W. Rep. 843.
- ⁷ Railroad Com'rs v. Symms G. Co., 35 Pac. Rep. 217.
- ⁸ Robinson v. Man. Ry. 25 N. Y. S. 91.
- ⁹ Everett v. O. S. L. & U. N. 34 Pac. Rep. 289.
- ¹⁰ Ft. Worth & D. C. v. Davis, 23 S. W. Rep. 737.
- ¹¹ Fordyce v. Dillingham, 23 S. W. Rep. 550.
- ¹² L. & N. v. Williams, 24 S. W. Rep. 1.
- ¹³ Duggan v. B. & O. 28 Atl. Rep. 182.
- ¹⁴ Fitzsimmons v. M. L. & S. W. 57 N. W. Rep. 127.
- ¹⁵ R. & D. v. Worley, 18 S. E. Rep. 361.
- ¹⁶ Beall v. P. C. & St. L. 18 S. E. 729.
- ¹⁷ Conlan v. N. Y. C. & H. R. 26 N. Y. S. 659.
- ¹⁸ K. C. & P. v. Ryan, 35 Pac. Rep. 292.
- ¹⁹ Browning v. Wab. West, S. W. Rep. 731.
- ²⁰ O. & S. W. v. McDowell, 28 S. W. Rep. 607.
- ²¹ Jarman v. C. & G. Ry. Co., 57 N. W. Rep. 32.

MEETINGS AND ANNOUNCEMENTS.

Stockholders' Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Manhattan Elevated, annual, New York City, Nov. 14.
Buffalo, Rochester & Pittsburg, annual, New York City, Nov. 19.

New Orleans & Northeastern, annual, New Orleans, La., Nov. 7.

Port Royal & Augusta, annual, Augusta, Ga., Nov. 20.

Raleigh & Augusta Air Line, annual, Raleigh, N. C., Nov. 8.

Raleigh & Gaston, annual, Raleigh, N. C., Nov. 8.

South Carolina & Georgia, annual, Charleston, S. C., Nov. 14.

Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *New York Railroad Club* meets at the rooms of the American Society of Mechanical Engineers, 12 West Thirty-first street, New York City, on the third Thursday in each month, at 8 p. m.

The *New England Railroad Club* meets at Wesleyan Hall, Bromfield street, Boston, Mass., on the second Wednesday of each month.

The *Central Railway Club* meets at the Hotel Iroquois, Buffalo, N. Y., on the fourth Wednesday of January, March, April, September and October, at 10 a. m.

The *Southern and Southwestern Railway Club* meet at the Kimball House, Atlanta, Ga., on the third Thursday in January, April, August and November.

The *Northwestern Railway Club* meets at the Ryan Hotel, St. Paul, on the second Tuesday of each month, at 8 p. m.

The *Northwestern Track and Bridge Association* meets at the St. Paul Union Station, on the Friday following the second Wednesday of March, June, September and December, at 2.30 p. m.

The *American Society of Civil Engineers* meets at the House of the Society, 127 East Twenty-third street, New York, on the first and third Wednesdays in each month, at 8 p. m.

The *Western Society of Engineers* meets on the first Wednesday in each month, at 8 p. m. The headquarters of the society are at 51 Lakeside Building, Chicago.

The *Engineers' Club of Philadelphia* meets at the House of the Club, 1122 Girard street, Philadelphia, on the first and third Saturdays of each month, at 8 p. m.

The *Engineers' and Architects' Club of Louisville* meets in the Norton Building, Fourth avenue and Jefferson street, on the second Thursday in each month, at 8 p. m.

The *Association of Engineers of Virginia* holds informal meetings on the third Wednesday of each month, from September to May, inclusive, at 710 Terry Building, Roanoke, at 8 p. m.

The *Boston Society of Civil Engineers* meets at Wesleyan Hall, 36 Bromfield street, Boston, on the third Wednesday in each month, at 7.30 p. m.

The *Engineers' Club of St. Louis* meets in the Missouri Historical Society Building, corner Sixteenth street and Lucas place, St. Louis, on the first and third Wednesdays in each month.

The *Engineering Association of the South* meets on the second Thursday in each month, at 8 p. m. The Association headquarters are at The Cumberland Publishing House, Nashville, Tenn.

The *Engineers' Society of Western Pennsylvania* meets in the Carnegie Library Building, Allegheny, Pa., on the third Tuesday in each month, at 7.30 p. m.

The *Technical Society of the Pacific Coast* meets at its rooms in the Academy of Sciences Building, 819 Market street, San Francisco, Cal., on the first Friday in each month, at 8 p. m.

The *Denver Society of Civil Engineers* meets at 36 Jacobson Block, Denver, Col., on the second and fourth Tuesdays of each month except during July, August and December, when they are held on the second Tuesday only.

The *Montana Society of Civil Engineers* meets at Helena, Mont., on the third Saturday in each month, at 7.30 p. m.

The *Engineers' Club of Minneapolis* meets in the Public Library Building, Minneapolis, Minn., on the first Thursday in each month.

The *Canadian Society of Civil Engineers* meets at its rooms, 112 Mansfield street, Montreal, P. Q., every alternate Thursday, at 8 p. m.

The *Civil Engineers' Club of Cleveland* meets in the Case Library Building, Cleveland, O., on the second Tuesday in each month, at 8 p. m. Semi-monthly meetings are held on the fourth Tuesday of each month.

The *Engineers' Club of Cincinnati* meets at the rooms of the Literary Club, No. 24 West Fourth street, Cincinnati, O., on the third Thursday in each month, at 7.30 p. m. Address P. O. Box 333.

The *Foundrymen's Association* meets at the Manufacturers' Club, Philadelphia, Pa., on the first Wednesday in each month.

The *Western Foundrymen's Association* meets in room 701, Western Union Building, Chicago, on the third Wednesday of each month. B. W. Gardner, Monadnock Block, Chicago, is secretary of the association.

The *Association of Civil Engineers of Cornell University* meets on Friday of each week at 2.30 p. m., from October to May inclusive, at their Association Rooms in Lincoln Hall, Ithaca, N. Y.

National Switchmen's Union of North America.

This is the title of an organization which was formed at Kansas City on Oct. 24 by a convention of switchmen from various prominent cities. It will be remembered that the Switchmen's Mutual Aid Association fell to pieces last summer, the Treasurer having stolen or wasted a large amount of money. It is said that the new organization will have a mutual benefit department for the payment of weekly benefits in case of injury, but no life insurance or indemnity for deaths. The headquarters of the Association will be in Kansas City, and the officers are D. D. Sweeney, Jersey City, Grand Master; M. R. Conton, Kansas City, Secretary and Treasurer. The next meeting will be held in Omaha a year hence.

The Technical Conventions.

The Joint Committee of the Master Car Builders' Association and the Master Mechanics' Association have decided on Thousand Islands, Alexandria Bay, N. Y., as the place for the next convention in June, 1895, the M. C. B. Convention commencing June 11. The committee has made the following arrangements with Mr. J. B. Wistar, proprietor of the "Thousand Island House," and Mr. Charles W. Crossman, proprietor of "The Crossman House," Thousand Islands, Alexandria Bay, N. Y., as to terms, as follows: Single rooms with board, \$3 a day each person; single rooms with board and bath, \$4 a day each person, and double rooms with two persons, \$3 a day each person.

These rates are to members of the association and their friends. Applications for rooms should be made to Mr. J. B. Wistar, "Thousand Island House," Thousand Islands, Alexandria Bay, N. Y., and Mr. Charles W. Crossman, "The Crossman House," Thousand Islands, Alexandria Bay, N. Y.

New England Railroad Club.

At the regular meeting of this club on Oct. 10 the first business was the adoption of resolutions on the death of Mr. J. N. Lander, long one of the most prominent members of the club. Fifty-five new members were elected. The principal addresses of the evening were by Mr. James M. Palmer and Mr. W. G. Creamer on "Ventilation of Passenger Cars." Mr. Palmer discussed the principles of ventilation, presenting figures showing the number of cubic feet that can readily be admitted to a car by the natural draught when running at various rates of speed, and he then went on to describe a car fitted up by him which has been running on the Boston & Maine between Boston and Lawrence for a year and a half past. He quoted commendatory statements regarding the car made by prominent railroad men and car builders. Mr. Palmer makes an air chamber in the end of each car, in the roof above the platform. This is connected by suitable ducts with channels on either side of the top of the car, extending the entire length of it. Each channel has a partition through its center. The channel is closed on the top, bottom and outer side while the inner side is of wire gauze. The dimensions of each channel are 6 in. x

15 in. The size of these channels is calculated to be about right for a car 60 ft. long, the capacity of which is about 4,600 cubic ft. When there are 75 passengers in such a car they require about 3,750 cubic ft. of air a minute, and at 35 miles an hour it is estimated that the passages provided will admit about that amount without objectionable draughts. Although the efficiency of the arrangement depends on the speed of the train and the partial closing of the openings by the brakeman when the speed is very high, it is claimed that the air is changed considerably even when the car is detached from the train. In January last this car and another, standing in a station, were tested for 20 minutes after the steam had been cut off from the heating pipes; in that time the temperature in the ventilated car fell from 70 degrees to 40, while in the other car it remained stationary at 70. Mr. Palmer recommends that in summer, when cars absorb heat while out in the sun and then prove very oppressive to passengers when placed in a covered station, they should be ventilated by two openings in the roof, each 2 ft. square.

Mr. Creamer gave reminiscences of his long experience in ventilating passenger cars. He held that a car full of passengers could not be properly ventilated except by the use of forced draught. It is impossible to ventilate by means of openings in the clear story without objectionable draughts.

Engineering Club of Cincinnati.

At the September meeting, Mr. George T. Waite, read a paper on the Progress of Electric Traction, which he reviewed from the application by Frank J. Sprague, of electricity for the purpose of propelling cars, down to the present time, noting the rapid progress that has been made in the construction of electric plants and motors, the improvement in track and road bed to accommodate the increased weight of cars equipped for electric propulsion.

At the October meeting, a paper by Mr. John W. Hill was read, under the title "Shall our Drinking Water be Sterilized," in which he called attention to various epidemics of typhoid fever that were traceable for their origin to the impure water. To avoid this he advocated the furnishing of pure water for domestic purposes, rendered so by filtration and distillation, in a plant established for that purpose, and supplied through a system of street mains independent of those supplying water for other uses. The cost of providing and operating a plant of this kind to supply a population of 400,000 he estimated approximately to be not to exceed \$1 per capita per annum.

The paper also contained an account of the results of some tests of drinking water, both filtered and unfiltered, made by the writer.

The American Academy of Railway Surgeons.

This Association, of which Dr. R. Harvey Reed, Consulting Surgeon of the Baltimore & Ohio, is chairman of the Committee on Permanent Organization, will hold its first meeting in Chicago, Nov. 9 and 10.

American Street Railway Association.

On the return trip from the annual convention of the American Street Railway Association, recently held in Atlanta, a number of delegates who traveled on the special trains via the Southern Railway and the Shenandoah Valley route, passed resolutions expressing their sense of the creditable way in which the parties were conducted by the agents in charge. In the case of the Southern Railway the resolutions were dated Hickory, N. C., and were signed by R. S. Brown, chairman; Charles W. Price, secretary; John M. Partridge, John H. Cunningham, W. L. Candee, and I. A. Shaler. Special mention was made of W. A. Turk, General Passenger Agent; S. H. Hardwick, Assistant General Passenger Agent, and to A. S. Thwait, Eastern Passenger Agent of the Southern Railway. The delegates particularly thanked Mr. George C. Daniels, New England Traveling Passenger Agent of the Southern, who accompanied the party on the entire trip, "for his courteous, tireless and unceasing attention." The other resolutions are dated Natural Bridge, Va., and are in behalf of Le Roy J. Ellis, Eastern Passenger Agent of the Norfolk & Western. Mr. Ellis receives the hearty thanks of the passengers on the special train, which he personally conducted, and is congratulated "upon the striking punctuality in the adherence to the train schedule as evidencing the high standard of railroad efficiency in the New South." These resolutions are to be engrossed and presented to Mr. Ellis, together with a solid silver pitcher as a souvenir. The Committee for Presentation consists of E. Peckham, W. J. Richardson, J. R. Beetem, J. H. McGraw, W. S. Silver and H. C. Evans. E. Peckham is chairman, and T. C. Martin, of the *Electrical Engineer*, Secretary.

Roadmasters' Clerks' Association.

The second annual convention of this association was held in Chicago, Oct. 16, Mr. P. D. Reith, President, in the chair. This is not a "labor" organization, but has been formed for the purpose of discussing subjects likely to be profitable to members in their work, and to foster brotherly intercourse. Roadmasters and other officers in that department are eligible for membership as well as clerks of all grades in this department. The meeting discussed the Griswold file, which was reported upon by a committee consisting of Messrs. George and Pratt, Mr. Griswold, who is in the Engineers' Department of the Lake Shore & Michigan Southern, files correspondence and other papers by subject numbers and uses an elaborate system of cross references, indexing the principal words in a subject by the initial letter and the first vowel in the word. Messrs. Roe, Reith and Burdett made a report on the best time book and distribution of labor sheet, which was followed by a brief discussion. Messrs. Lombard, Massnick and Midwinter reported on blank forms for reporting work done by steam shovels. The officers chosen for the ensuing year are: President, George Ackerman, Illinois Central, Chicago; Secretary, Henry Roe, Michigan Central, St. Thomas, Ont. The next meeting will be at Cincinnati, Sept. 17 and 18, 1895.

Canadian Society of Civil Engineers.

The special paper prepared for the last meeting of this society at Montreal, which was on Oct. 25, was entitled "Notes on Retaining Walls in Montreal," and was read by the author, Mr. H. Irwin, member of the society. The discussion was on Mr. D. A. Stewart's paper on "Building Railways Over Peat Bogs or Swamps," which elicited an animated discussion when it was read at the September meeting of the society.

PERSONAL.

—Mr. G. W. Luce, General Freight Agent of the freight department of the Union Pacific, at San Francisco, has been appointed Assistant General Freight Agent of the Southern Pacific.

—Mr. Charles A. Sheldon, Superintendent of the Michigan division of the Lake Shore & Michigan Southern road, has tendered his resignation. He will engage in business in New York.

—Mr. S. H. Wenck, Auditor of the Erie Despatch Pass. Freight Line for several years, has resigned that office. He is now residing at 120 Harrison avenue, Montclair, N. J. He has been an officer of quite unusual fidelity and ability.

—Mr. T. W. Garrett, General Manager, and formerly Receiver of the Atlanta & Florida Railroad in Georgia, has recently resigned that office. Mr. W. E. Algee, Secretary, Treasurer and Auditor, has also resigned his connection with the company.

—Mr. J. C. Hutchins, Roadmaster of the northern division of the Yazoo & Mississippi Valley branch of the Illinois Central system for years past, has resigned his position, to take effect Nov. 1, having been appointed by Major J. M. Edwards, Manager of the Detroit Electric Railway of Detroit, Mich., of which R. T. Wilson & Co., the New York bankers, are the owners.

—Mr. S. G. Dickerson, whose appointment of Superintendent of Transportation of the Seaboard Air Line, was announced on last week, resigned that office within a few days of his appointment, the reasons for his resignation not being assigned. He has been in the service of the roads comprised in the Seaboard Air Line for over 15 years.

—Mr. Frederic Danforth, of Gardiner, Me., has been named by the Governor for Railroad Commissioner of Maine, succeeding Colonel Wildes, deceased. Mr. Danforth is a civil engineer of note, and a prominent member of the American Society of Civil Engineers. His professional experience has been largely in Maine, and in the last few years he has built many new railroads in that State, as Chief Engineer or as a contractor.

—Captain V. E. McBee has been appointed Division Superintendent of Transportation of the Seaboard Air Line, to succeed S. G. Dickinson, who was recently made General Superintendent of the Transportation Department. Captain McBee is an experienced and competent railroad man. He was for a long time connected with the old Richmond & Danville system in a similar capacity, but retired upon the reorganization of that road as the Southern Railway. Superintendent McBee's headquarters will be at Atlanta, Ga.

—Mr. R. W. Baxter, who was Assistant General Superintendent of the Union Pacific Railroad at Portland, Ore., before the severance of the Oregon Railway & Navigation Co.'s lines from the control of the Union Pacific Receivers, has recently been appointed General Agent for the Freight and Passenger Department of the Union Pacific at Portland, Ore., in charge of that company's interests on the Pacific Coast. Since the separate Receiver was appointed for the Oregon Railway & Navigation Co., the Union Pacific has had no office on the Pacific Coast.

—Mr. H. R. Nickerson, who became Assistant General Manager of the Mexican Central Railroad in June last, has now been appointed General Manager of the company. He succeeds Mr. E. W. Jackson, who retires from the position of Vice-President and General Manager to accept a similar office on the Inter-Oceanic Railroad of Mexico. Mr. Nickerson's headquarters will be at the City of Mexico, and the promotion gives him complete charge of the operating department of the railroad. President A. A. Robinson, who has had his headquarters at the City of Mexico since his election as President, has apparently removed his office to the executive offices of the company at Boston, Mass.

—Mr. W. B. Thomas, who has been General Manager of the Augusta Southern Railroad for two years, has been made Receiver of the Atlanta & Florida Railroad, with headquarters at Atlanta, Ga. This road has had a disastrous history since it was built five years ago. Mr. Thomas is probably as well fitted as anyone to lessen the divergence between the company's income and outgo, for no one will look to him to make both ends meet. He has been Manager of the Wrightsville & Tennville, Blue Ridge & Atlanta, and other short lines in Georgia, all of which he has operated with a remarkably small percentage of operating expenses to gross earnings.

—Mr. D. W. Caldwell was elected President of the Lake Shore & Michigan Southern Railroad, to succeed the late John Newell, at a meeting of the Directors at the Grand Central Station, in New York, on Oct. 30. Upon the death of Mr. Newell, Mr. Caldwell was made General Manager of the Lake Shore road by the Directors on Sept. 3. It was semi-officially announced at that time that he would be made President at a later date. Mr. Caldwell has been connected with the New York, Chicago & St. Louis Railroad (the Nickle Plate) as Vice-President, Receiver and President since 1882. He has had a long experience in railroad service, and is an officer of quite unusual executive ability. He was with the Pennsylvania for 30 years, as Civil Engineer, Superintendent, and General Manager. He was appointed to the latter office on various of the lines west of Pittsburgh in 1874. In 1881 he was made General Manager of all lines west of Pittsburgh. He left the service of the Pennsylvania Co. to become Vice-President of the "Nickle Plate" in 1882. He served also as Receiver of the latter road from March 28, 1885, until Oct. 1, 1887, on which latter date he was made President of the reorganized company, and still holds that position. Mr. Caldwell bears some resemblance to Mr. C. P. Huntington, of the Southern Pacific, in personal appearance. He is now 63 years of age.

ELECTIONS AND APPOINTMENTS.

Blue Mountain.—The reorganization of the South Mountain Railroad, under the name of the Blue Mountain Railroad, has been effected, with general offices at 926 Walnut street, Philadelphia. The officers are as follows: President, Clinton Rorer; Treasurer, George F. Murray; Secretary, Frank Benton; Chief Engineer, Robert Frazer; Superintendent of Construction, James Clarke, and General Counsel, William C. Mayne.

Carrabelle, Tallahassee & Georgia.—In addition to his duties as Chief Clerk to J. A. McDuffie, the General Manager of the Carrabelle, Tallahassee & Georgia Railroad and Gulf Terminal & Navigation Co., B. Rice has been appointed Superintendent of the railroad company and the steamship line, with headquarters at Tallahassee, Fla. Mr. Rice will have full control of all transportation matters.

S. D. Chittenden has been appointed Purchasing Agent for the railroad and the Gulf Terminal & Navigation Co., with headquarters at Tallahassee, Fla.

Choctaw, Oklahoma & Gulf.—The following appointments have been made: J. D. Bradford, Superintendent of Railroad; Edwin Ludlow, Superintendent of Mines; James F. Holden, Auditor and Traffic Manager; George

E. Starr, Cashier and Paymaster; F. L. Moeller, Superintendent of Transportation and Car Accountant; James Cunningham, Master Mechanic; W. E. Pollock, Superintendent, Western Division; B. F. Dunn, District Freight and Passenger Agent, and J. W. McCloud, General Solicitor. Francis I. Gowen is President and General Manager, with office at 420 Walnut street, Philadelphia. The local office is at South McAlester, I. T.

Cleveland, Cincinnati, Chicago & St. Louis.—The appointment is announced of T. C. Wells as Passenger Agent, with headquarters at St. Louis. Mr. Wells was formerly District Passenger Agent of the Baltimore & Ohio Southwestern, at St. Louis.

W. B. Poland has been appointed Chief Assistant Engineer of the company, with headquarters in Cincinnati.

Cornwall & Lebanon.—At a special meeting held in Lebanon, Pa., Oct. 25, A. A. Rogers resigned as President, and Messrs. A. Hess, C. W. Few and Grant Weidman as Directors, Mr. Weidman being retained as Solicitor. B. Dawson Coleman was elected President, and Messrs. Edward R. Coleman, L. Heber Smith, Walter Scranton, A. Archibald Rogers and Henry T. Kendall were elected Directors. The board now consists of the above newly elected members and Messrs. John Meily, J. H. Redsecker and C. Shenk.

Cuyler & Woodburn.—The incorporators of this company, recently organized in Alabama to build a 12-mile line from Cuyler, in Bryan County, to Woodburn, in Bulloch, are Messrs. J. N. Wood, J. E. Hogan, R. W. Jones, O. R. Slaton, W. H. Cone, J. H. Blitch, K. H. Cone, and B. F. Hogan.

Evansville & Terre Haute.—At a meeting of the Directors of the company last week the following officers were elected: H. G. Barlow, President; W. H. Tilford, of New York, President of the Board of Directors; G. S. Wright, Secretary and Treasurer, and J. R. Taylor, Assistant Secretary. At a meeting of the Directors of Evansville & Indianapolis the following officers were elected: H. C. Barlow, President; G. S. Wright, Secretary and Treasurer; J. R. Taylor, Assistant Secretary.

Evansville & Richmond.—H. R. Griswold has been appointed General Freight and Passenger Agent of the road, vice H. P. Radley, resigned.

Florida Central & Peninsular.—Edmund Dana Palmer, son of L. H. Palmer, the Passenger Agent of the Fall River line at Boston, has been appointed Freight and Passenger Agent of the Florida Central & Peninsular Railroad Co., with headquarters at 197 Washington street, Boston.

La Porte, Houston & Northern.—At the annual meeting of the stockholders of the company at La Porte, Tex., the following Board of Directors was elected: A. N. York, J. H. York, I. R. Holmes, T. W. Lee, and T. W. Ford. The Directors elected A. N. York, President; J. H. York, Secretary, and T. W. Ford, General Manager. T. W. Lee, formerly General Manager of the road, has resigned to accept a position with the Union Pacific, with headquarters at Portland, Ore.

Missouri Pacific.—W. W. Conklin has been appointed Chief Clerk to the Locomotive and Car Department under Superintendent Reardon. Mr. Conklin has filled a similar position with the Union Pacific at Omaha for many years.

New Orleans & Southern.—L. A. Brooks has been appointed Superintendent of Motive Power.

New York, New Haven & Hartford.—The following changes have been announced: I. N. Marshall, Superintendent of the Providence division, has been transferred to the Northern division; C. A. McAlpine, Superintendent of the Northern division, has been transferred to the Providence division. The changes take effect Nov. 1.]

Northern Pacific.—Henry S. Redmond, a banker of New York, has written to President Ives that he will not qualify as a director, to which office he was elected at the recent stockholders' meeting. He is chairman of the committee of the second mortgage bondholders of the Union Pacific, and his decision not to accept the office was arrived at after consulting with other members of the committee.

Richmond, Petersburg & Danville.—The Directors of this company, elected by the City Council of Petersburg, Va., are R. T. Arrington, Augustus Wright, E. A. Hartley, E. C. Venable, H. C. Roper, J. E. Molyer, John McGill, and C. C. Alley, all of the city of Petersburg, Va. Bartlett Roper was elected President.

St. Paul & Duluth.—J. R. Woodhead, Chief Accounting Clerk in the Auditor's office of the Omaha Road at St. Paul, has been appointed Chief Clerk in the St. Paul & Duluth Auditor's office, succeeding W. F. Pretts. Mr. Pretts' health has been unsatisfactory lately, and he will likely accept a position as Traveling Passenger Agent for a while.

St. Louis & San Francisco.—The annual stockholders' meeting at St. Louis, on Oct. 30 was held. The following were elected Directors without opposition: Edward King, James T. Woodward, C. C. Rawlins, W. Emmons Roosevelt, John J. McCook, New York; E. B. Welsley, Rye, N. Y.; J. V. B. Thayer, Brooklyn; B. P. Cheney, Jr., Boston; Joseph C. Wilson, Topeka, Kan.; H. L. Morrill, J. E. McKeighan, R. C. Kerens, St. Louis; Aldace F. Walker, Chicago. The new Board will meet in New York within ten days to organize.

Union Pacific.—R. W. Baxter has been appointed General Agent, with headquarters at Portland, Ore.

Thomas M. Schumacher has been appointed General Agent of the Freight Department at San Francisco, vice G. W. Luce, resigned. Mr. Schumacher has been connected with the Union Pacific for the past seven years as Chief Clerk in the General Freight office at St. Louis and Omaha.

RAILROAD CONSTRUCTION, Incorporations, Surveys, Etc.

Baltimore & Cumberland.—The company has engaged J. C. Onderdonk to resurvey a portion of the route surveyed some time ago by Chief Engineer Chauncey Ives, from Cumberland to Hagerstown, Md., 80 miles. The road is projected as an extension from Cumberland eastward to a point a few miles north of Hagerstown, where it will connect with the Cumberland Valley. It is intended to give an outlet to the seaboard for the coal mined in the territory tributary to the West Virginia Central road in West Virginia.

Buffalo & Susquehanna.—This new line in Potter and Clinton counties, Pennsylvania, was opened for traffic Oct. 29, through to the connection with the Fall Brook Railroad. Regular trains are now running between Keating Summit and Ansonia, 40 miles. The road opens up a lumber region in Potter and Clinton counties. It was built largely by F. P. & C. W. Goodyear, of Buffalo, who are now the largest lumber operators in Pennsylvania. They expect to make the road a line for passenger traffic

as well as for freight business. A line is also being surveyed to Coudersport from Ulysses and Galeton. M. E. Olmstead, of Harrisburg, Pa., is President.

Buffalo, Attica & Arcade.—We have noted in this column, from time to time, the various changes in the history of this company, and have said something of the plans of the new company for the improvement of the property. We are, however, glad to publish, at this time, an interesting statement from Mr. S. S. Bullis, who now controls the road, giving particulars of the work now going on, and some account of the early history of the company. Mr. Bullis' account follows: The route is the old Attica & Freedom Railroad, extending from Attica south through the county of Wyoming to Freedom, N. Y., 33 miles. The road is now being rebuilt as a standard gage line from Attica to Arcade, and it is expected to complete the work and open it as a standard gage road between these two points, 26 miles, by Dec. 15 of the present year. The grade of this railroad was built in 1852-53, with 12 ft. banks and in a first-class manner for a 6 ft. gage railroad. The ties were put down, and it was all built ready for the rails as far south as Arcade, under the name of the Attica & Allegheny Valley Railroad. Some work was done south of that point, but no part of it complete; the work at that time was virtually abandoned without laying any rails south of Attica. In 1871 a corporation was organized to go on with the work under the name of the Attica & Arcade Railroad, but practically did nothing. In 1881, the parties interested in the Erie Narrow gage roads laid a narrow gage track on this line, extending south to Cuba, and from there through the oil regions of Pennsylvania, but only operated the whole line for a short time, abandoning the road south of Sandusky in a few months. This part of the road has been operated as a narrow gage road since that date, until by foreclosure sale it was sold to the Continental Trust Co., of New York, in March of this year. The property from this trust company was purchased by Mr. Bullis, who has organized a new company. He has already placed in the roadbed 35,000 ties, rebuilt the trestles, and is now laying 65-lb. rails upon the roadbed. The work now going on is being done by the company's men. The filling of the trestles requires some 40,000 yards of earth, which will be undertaken at an early date. The present officers are S. S. Bullis, Olean, N. Y., President, C. V. Merrick, Bradford, Pa., Vice-President and Treasurer, and G. W. Conklin, of Attica, N. Y., General Superintendent.

Chicago, Paducah & Memphis.—B. F. Johnston, General Manager of the railroad, states that he has made financial arrangements for completing the road to a connection with the Wabash at Altamont, Ill. He also states that he has placed the order for the rails for this line with the Illinois Steel Co.; that the grading and bridging is progressing satisfactorily, and he expects the line to be completed from Altamont to Marion, Ill., by Jan. 1.

Chicago, Iowa & Dakota.—President Miller, who was elected to that position a few months ago, is reported to favor the building of the proposed extension next year. Meetings will soon be held at Clarion and other points along the line of the proposed extension to arrange for the location of the road. If the necessary aid can be secured the management will build from Alden northwest about 25 to Clarion, and perhaps from that place northwest to some point in Minnesota. The railroad offices are at Eldora, Iowa.

Choctaw, Oklahoma & Gulf.—The formal award of the contract for building the 125 miles of railroad to connect the Eastern and Western divisions of this company, is expected to be announced within a few days. The bids received during October are now being tabulated at the Philadelphia office of the company, 420 Walnut street. All the surveys for the line have been completed, and the company is ready to go ahead with the work as soon as the award is made. The work will be under the direction of J. F. Hinckley, as Chief Engineer, who is now in Philadelphia. There is only one important bridge on this line, that across the South Canadian River, which will be about 800 ft. long. The construction work will be very easy, the maximum grades not exceeding one per cent. The line will extend from South McAlester, I. T., to Oklahoma City. This company is the reorganization of the Choctaw Coal & Railway Co., and J. D. Bradford is Superintendent of the railroad now being operated.

Cincinnati, Georgetown & Portsmouth.—The Chief Engineer is now going over the line of the proposed extension to West Union. The directors of the road have determined to extend it to West Union, and work will be begun in a short time. The extension will be from Georgetown, southwest, and will be 20 miles long.

Clearfield Quarrying Co.—The grading is nearly completed on a branch road being built by this company to its quarries from a connection with the Buffalo, Rochester & Pittsburgh. The quarries to be reached by the new line are near Clearfield, Pa., and are said to be among the largest in the State. The stone from the quarries is being used largely for bridge work along the Delaware River.

Cleveland, Cincinnati, Chicago & St. Louis.—It is again reported that the work of construction on the long-talked-of extension into Louisville is to be pushed without further delay. The route is already surveyed and partly graded.

Colorado Western.—The chief projectors of this railroad, a notice of whose incorporation was published last week, are understood to be the Gilson Asphaltum Co., of St. Louis, and other interests in that city. Mr. George Goss, Chief Engineer of the Rio Grande Western, has gone over the route proposed for the road during the last few months. The object of the railroad is to reach the asphaltum deposits, in the Uncompahgre Ute reservation in Utah. The line, it is understood, will leave the Rio Grande Western at Crevasse, Utah, and then extend up Wagon Canon and down Evacuation Creek and White River to the Ouray Agency, and thence to a connection with the Utah Central Railroad in Utah.

Cuyler & Woodburn.—The incorporation of this railroad in Georgia was noted last week. The charter was secured for a line in Bryan County, Ga., west of Savannah, from Woodbury to Meldrim, 14 miles. From Meldrim to Cuyler, a distance of two miles, the track, of the Savannah, Americus & Montgomery will be used. The roadbed has already been graded, and the ties laid by the Smith & Kilby Co., a lumber firm of Anniston, Ala. The rails will be laid at once by the new owners, among whom are J. N. Wood, of Savannah, and F. T. Lockhart, of Augusta, Ga. The new road extends through the country between the Ogeechee and Nacoochee Rivers, connecting the Central of Georgia and the Savannah, Americus & Montgomery. The rails are expected to arrive at Cuyler this week, and the road will be completed without delay.

Duluth, Missabe & Northern.—Some time ago the company began condemnation proceedings for a branch to the Adams mine, in Northern Minnesota, and this work

is so well along that the contract for its building will be let in the near future. It is understood also that the company will in the near future construct a spur from Iron Junction to Eveleth, Minn., as recently stated.

Ebensburg & Black Lick.—Charles McFadden, the well-known contractor of Philadelphia, has just completed the track laying on this branch of the Pennsylvania, and the road commenced business on Oct. 29. Mr. McFadden has commenced work on the construction of a 1½-mile branch up Coal Pit Run to connect with the above line.

Florence & Silver Cliff.—W. K. Johnson, of the Florence, Cripple Creek & State Line Railroad, says that though no definite arrangements have been made for building the railroad to Silver Cliff from Florence, Col., everything looks favorable, though no positive statement can be made for several months. Chief Engineer H. A. Sumner started out some months ago at the head of a surveying party to do the preliminary work, and the line has now been settled upon through a canon 20 miles from Silver Cliff, and about the same distance from Florence. With this done the chief difficulties have been surmounted, and a party has started out to run lines over several feasible routes from that point to Silver City. The road when built will be owned by the same men who control the Florence, Cripple Creek & State Line.

Genesee & Wyoming Valley.—Work has been begun on the extension from Retsof to Caledonia, N. Y., making connection with the Buffalo, Rochester & Pittsburgh, Erie, New York Central, Lehigh Valley and Western New York & Pennsylvania roads. All the surveys have been completed by Engineer Dewitt, of New York.

Georgetown & Granger.—The Directors have called a meeting of the stockholders to arrange for the consolidation of this road with the Trinity, Cameron & Western, an uncompleted line. Arrangements are also to be made to authorize the transfer of the stock to M. P. Kelly & Co., who have undertaken to build the line from Georgetown, Tex. They have engineers on the Trinity branch of the road locating the permanent line. Captain Emzy Taylor intends to visit New York soon to close various contracts.

Hinton & New River.—The Summers County Court, at Hinton, W. Va., has ordered a special election to be held Nov. 27, to decide whether or not the county shall subscribe money to aid in the construction of the proposed railroad through the county. The road is to join the Chesapeake & Ohio at Hinton with the Norfolk & Western at Glenn Lynn. The surveys have been made during the year.

Illinois Central.—The citizens of Bolton and Raymond, La., have secured the right-of-way of the old Bolton & Raymond Railroad project, with the purpose of tendering it free to the Illinois Central Railroad Co. The road was abandoned nearly 40 years ago, but the grading and embankments are said to be in good condition, and to require very little labor to reconstruct.

Jamestown & Lake Erie.—The charter issued to this company, which is a reorganization of the Chautauque Lake Railroad, includes a line in addition to the road now built along Chautauque Lake, from Falconer, a few miles east of Jamestown, the present southern terminus, to Westfield, N. Y., 10 or 12 miles. Just what likelihood there is of this extension being undertaken in the near future has not been very clear, but Mr. W. E. Griggs, who is General Manager of the new company, as he was of the old, is reported to have stated that there is some chance of the work being undertaken during next year.

Macon, Dublin & Savannah.—This company, which has 54 miles in operation, from Macon to Savannah, Ga., has recently had a preliminary line run from Dublin to Savannah, a distance of about 100 miles, with a view of extending the line. Mr. D. B. Dunn, M. Am. Soc. C. E. (Macon, Ga.), is Chief Engineer. The Atlantic Short Line Railroad closely parallels this line, and has about 70 miles graded, and is doing some work at present, but the question to be decided, is supposed to be, which company shall buy out the other, or which will be the first to perfect its financial arrangements.

Marquette, Tomahawk & Western.—The company has filed articles of organization in the office of the Secretary of State, at Madison, Wis. The road is to extend from Marquette northwest to the town of Tomahawk, a distance of 110 miles.

Mohawk & Sierra Valley.—This Nevada company has been organized, and a contract let to W. H. L. Knox for putting that part of the road, built several years ago, in repair, and a new contract let for grading and laying track on nine miles of new road, which will take it to a point four miles above Beckwith, Nev., in the Sierra Valley. The company will have trains running over the 23 miles by December.

New Roads.—Colonel D. M. Yeomans was at Pomeroy, O., for some time last week furthering a project for building a railroad connecting the Pomeroy Belt Railroad with railroads running north to Cleveland, so that the steam coal from the Pomeroy coal fields could be carried to Lake Erie. The connection desired could be secured by building a line from Pomeroy to Coolville or to Marietta.

H. B. Camp is building a short railroad into the town of Jeromeville, O., and he has agreed to extend it northeast 10 miles to Ashland, O., if \$35,000 is given as a subsidy, and free right of way is secured.

S. A. Hughsley, Jr., of Augusta, is the projector of a short railroad in Jefferson County, Ga., which, if built, would give Augusta new connections with over 100 miles of railroad, reaching nine counties of the State. He has submitted his plans to the Business League of Augusta, and expects the aid of the League. Augusta is now connected by rail with Matthews Station via the Augusta Southern. This road is to change its gauge to standard. It is proposed to build 13 miles of new road from Matthews to Louisville, which would connect with the Louisville & Wadley, and the Wadley & Mount Vernon. This road, on account of the death of Mr. Dunovan, the projector, was not completed to Mt. Vernon, but stopped at Blackville, 18 miles north of the town. It is proposed in the plan that Mr. Hughsley will submit to continue the road to the point originally intended.

Nippenose.—The residents of this valley in Eastern Pennsylvania are undertaking to build a railroad with their own capital, the connecting railroads having failed to promise to undertake the work for them. At a recent meeting at Oval, Pa., a committee, with John Engler, of Oval, as chairman, was appointed to see what right of way could be secured, and what amount would be subscribed by the land owners to connect the valley with the city of Williamsport. The committee was authorized to employ engineers to make a preliminary survey for the 10 miles of railroad, which it will be necessary to build if the project is ever carried out.

Petersburg Belt.—The work on the belt extension of the Atlantic Coast Line, at Petersburg, Va., is being pushed ahead with all possible speed. The iron bridge across the Appomattox River is about half finished. The height of this bridge is 87 ft. from the river. It is expected to have the road completed about Dec. 1.

Philadelphia & Pittsburg.—Last week President S. H. Hicks of Philadelphia, met several local parties at Indiana, Pa., interested in the road, who have been engaged in securing the rights of way for the new road, and who reported that this work was nearly completed. Mr. Hicks stated that two parties of surveyors are working on the line. It is expected a large portion of the road will be under contract about Jan. 1, and the actual construction will be commenced immediately after.

Pittsburg & Lake Erie.—The branch of this railroad to the proposed driving park at Monaca, near Pittsburg, is, it appears, to be merely a siding a little more than one mile long. The survey is now being made under the direction of J. A. Atwood, Engineer of the railroad. The building of the line depends largely on the estimated cost of the work when it has been located, and the route adopted, and also upon the success of the plans for laying out the driving park, which is as yet merely proposed. The suggested site for the course is on a bluff on the south bank of the Ohio River, opposite the mouth of the Beaver River.

Prentice, Antigo & Eastern.—A company has been organized under this name at Merrill, Wis. The officers are S. Heineman, president of the National Bank, and H. H. Foster, secretary. The company intends to build a railroad from Prentice by way of Merrill and east to Antigo. It is proposed to connect with the "Soo" and Wisconsin Central Railroads at Prentice, and Chicago & Northwestern at Antigo. The distance to be built is about 70 miles, and the line, would open up a fine hardwood and hemlock district.

Providence, Ponegansett & Springfield.—The officers of this company have recently appeared before the City Council of Providence, R. I., to support the company's petition for a municipal guarantee of bonds. The corporation will first build a line to Danielsonville, a distance of 38 miles, and asks a bond guarantee of 30 years. T. B. Potter, representing the company, said that the request is that the city of Providence shall guarantee four per cent. interest on the bonds. The plan is to dispose of the bonds to the extent of \$800,000, and the company enabled to build the road on to Springfield. The city is also asked to provide for \$200,000 above the \$800,000.

Quebec & Lake St. John.—The company has a charter to extend its railroad from Chicoutimi to St. Alphonse, Que., on Ha-Ha Bay. The residents of St. Alphonse are anxious that this extension, which is about 12 miles long, should be built next summer. The officers have not given any assurance that the work will be undertaken then, and the residents along the route are talking of organizing a company to build the line, with the aid of the subsidy that may be secured from the Dominion Government.

San Antonio & Gulf Shore.—The first consignment of 60-lb. rails to be used in the construction of the first ten miles of the railroad, have arrived at San Antonio, Tex., and the track-laying will begin at once. Thirty miles of roadbed is completed, and three bridges on the line are now in process of construction.

Silver Springs & Western.—The projectors of this road, which is a local line through Marion County, Fla., beginning near Ocala, Fla., announces that they will begin the work of construction at Silver Springs, in that county, on Nov. 15.

Southern Pacific.—The grading on the Coast division, now building south of San Luis Obispo, Cal., is almost complete to the town of Grover, 15 miles south of San Luis Obispo. The line is ready for the rails for only part of this distance. The culverts and bridges are delaying the work. The only heavy work not yet completed to Pismo is a deep cut about a mile south of the Cormack mine. This cut is about 70 ft. deep and some 400 ft. in length, and by the time it is completed the first 15 miles of road will be ready for the rails. At the mouth of Price's canyon, the road turns to the left, leaving the town of Pismo, and then extends due south until it reaches its nearest approach to the ocean, at the town of Grover, about three miles distant. Here the line runs within a few hundred feet of the breakers, and at this point a station will be built. Within six weeks the road will be completed to that point. On the sandy plain between Grover and Oceano, no work has yet been done, but the work is light, and a few weeks will suffice to prepare the roadbed between the two points. South of Oceano—the station at the mouth of Arroyo Grande Creek—the grade is completed for a considerable distance, and if work is continued at the present rate of speed, will reach Guadalupe before April 1.

Stuttgart & Arkansas River.—Rails are now being received at DeWitt, Ark., for the extension of this road. Indications now are that the road will be completed as far as Gillett in the southern portion of the county, in a few weeks. This will make the road as completed about 40 miles long, the terminus being about 10 miles north of the Arkansas River.

Toledo & Ohio Central.—The long fight which this company has had to get the right of way for a grade crossing over certain streets on the west side of the city of Columbus, O., has ended in a victory for the company and the way is open for a resumption of construction work on the belt line.

Toronto, Hamilton & Buffalo.—Contractor Bracey, of Chicago, who has a contract for building this road out of Hamilton, Ont., made a start on the grading at that city last week. As the company secured at a recent election at Hamilton a favorable vote on its application for a subsidy amounting to \$125,000, there may be a better chance for the work being carried on steadily than happened four years ago, when the grading was begun at the same town, and was discontinued within a few months. The contract of Mr. Bracey is understood to be for the line from Hamilton through Brantford to Welland, and he proposes to let sub-contracts in short sections.

United States Coal, Iron & Mfg. Co.—This company, which owns and operates extensive coal and timber property near Belington, W. Va., is reported to have decided definitely to build a railroad from Belington, Barbour County, to Roaring Creek Junction, in Randolph County, to further develop the region. Final surveys have been made. The new road will connect with the Baltimore & Ohio at Belington, and with the Roaring Creek & Charleston, now building, at Roaring Creek Junction.

West Virginia Central & Pittsburg.—Mr. F. A. Parsons, who, in charge of an engineering party last year

made a survey of a line up Craven's Run in a southerly direction from the city of Elkins, has again placed a party in the field on the same work. The new line is part of the plan for a connecting link between the West Virginia Central & Pittsburgh, and the Chesapeake & Ohio. It will be a coal and timber feeder for the West Virginia Central from the start, and part of a through connecting line when completed.

Wheeling & Lake Erie.—W. H. Cole, of this company, stated last Friday that his company would begin before Nov. 10 on the construction of an extension from its present terminus, at the upper end of Martin's Ferry, O., where it forms a junction with the Wheeling Bridge & Terminal Railroad, to Bridgeport, O., about three miles below, over the right of way recently secured along the Ohio River bank. The trestles and timbers have been prepared, and the company hopes to be accepting freight in Bridgeport by February. This extension is of importance, as it gives the Wheeling & Lake Erie access over its own tracks to at least ten of the large mills and factories in the Ohio Valley. The cities of Martin's Ferry and Bridgeport have given free right of way over all streets along the route, and the private property needed has been purchased.

GENERAL RAILROAD NEWS.

Akron, Bedford & Cleveland.—The incorporation of this company in Ohio was noted last week. The incorporators are John F. Seiberling, F. A. Seiberling, James Christy, Jr., Charles H. Howland, and W. Christy, of Akron, O.

Atlanta & Florida.—For the third time during the present year this railroad is operated under a Receivership. Its latest experience of this kind came last week, when W. B. Thomas, of Augusta, was appointed Receiver by the United States Circuit Court at Atlanta, Ga., under an order secured by H. E. Tompkins, one of the Directors, and attorney of the Central Trust Co., of New York, trustee of the first mortgage bonds. Only a few days before that E. C. Spaulding, of Atlanta, who had been appointed on the application of local creditors, had been discharged on the settlement of these debts. The company entered upon the year under the management of T. W. Garrett, as Receiver, who was discharged from the latter office about April. The first mortgage bonds amount to \$840,000, and the Central Trust Co. has claims against the company amounting to \$147,000, representing advances for the expenses of the last foreclosure and reorganization, and in part for ordinary operating expenses during the last several months.

Chicago & West Michigan.—The company has notified holders of its first mortgage bonds and those of the Chicago & North Michigan Co. guaranteed by it that it cannot pay in full the December and November coupons on these bonds. Instead the company offers to pay one-half in cash and one-half in coupon scrip, payable in ten years, with five per cent. interest.

Cincinnati Southern.—The hearing on the application for a foreclosure of the mortgage securing the Cincinnati extension 5 per cent. bonds has been postponed until November 9.

Danville, Hazelton & Wilkesbarre.—Judge Thayer, in the Common Pleas Court, at Philadelphia, has rendered an opinion deciding that the Pennsylvania Railroad as the lessee of the Sunbury, Hazelton & Wilkesbarre Railroad, formerly known as the Danville, Hazelton & Wilkesbarre Railroad, which extends from Sunbury to Tomhicken, Pa., is not responsible for the payment of the interest upon \$1,400,000 construction bonds of the leased line. The decision was delivered in a suit brought for recovery on the ground that the Pennsylvania Railroad had guaranteed payment thereof.

Jackson, Louisville & St. Louis.—A meeting of the bondholders of the company was held last week at Philadelphia. The bondholders' committee reported that in order to prevent the passing of the control of 52 miles of the road from Jacksonville to Litchfield, a fund sufficient to pay off a \$300,000 first mortgage upon which foreclosure proceedings have been instituted must be subscribed. A partial plan of reorganization was also presented. The plan contemplates taking the road out of the hands of the Receiver and placing the bondholders in control. The details will not be worked out until the foreclosure of the mortgage has been settled.

Middletown & Cincinnati.—This railroad, owned largely by Congressman P. J. Sorg, of Cincinnati, was sold last week at the Lebanon Court House, O., by the Receiver, for \$335,000. Mr. Sorg, through his attorney, was the only bidder. The debt of the road is over \$311,000. The sale was made upon the judgment in favor of the creditors, Mr. Sorg being the heaviest interested party. It is thought that the property will soon be transferred to the Cincinnati, Jackson & Mackinaw, to be utilized by that company in connection with the Cincinnati, Lebanon & Northern, for an entrance to Cincinnati. It connects with that road north of Cincinnati, and extends to Middletown, 15 miles.

Minneapolis & St. Louis.—Under the plan of reorganization of the company a payment of \$4,000,000 was made this week to the Directors of the Chicago, Rock Island & Pacific Railroad Co., in settlement of its claim for an equal amount of equipment bonds.

New York & New England.—Judge Colt, in the United States Circuit Court, at Boston, has entered an order authorizing the Receivers to issue Receivers' certificates to the amount of \$684,629.

Pittsburg, Virginia & Charleston.—The consolidation of the McKeesport & Bessemer, the Monongahela River & Streets Run, and the Brownsville & State Line roads, with the Pittsburg, Virginia & Charleston, has been completed, and the stockholders of this line at a recent meeting approved the step taken. The roads in question are all branches of the Pennsylvania in Western Pennsylvania. Until the present time they have had independent organizations.

Prairie du Chien & McGregor.—This railroad company has transferred its three miles of road, including the Pontoon bridge, at Prairie du Chien, Wis., to the Chicago, Milwaukee & St. Paul Railroad.

Rome.—This railroad has been sold to the Nashville, Chattanooga & St. Louis Railroad Co. and will be operated under full control by November 1. The road extends from Kingston to Rome, Ga., 20 miles.

Savannah & Atlantic.—The rebuilding of this railroad between Savannah and Tybee Island, which has been undertaken by the Central of Georgia, under an order of the United States Court, is now progressing steadily. The road has been rebuilt as far as the twelfth mile post from Savannah. The principal work to be done now is on Tybee Island, in filling in several extensive washouts where the track and roadbed were entirely destroyed. The trains will probably be running on the entire 18 miles during November.

South Jersey.—At a conference, last week at Philadelphia, between the Receiver and the bondholders and creditors of the railroad company, a committee was appointed to draft a plan of action for the approval of the creditors. The committee will consider the advisability of asking the court to issue Receivers' certificates for \$50,000 and the question of foreclosure.

Southern Pacific.—The Receivers of the company have been authorized by an order filed in the United States Court at St. Louis, to advance money toward the payment of \$428,133, the amount due the Southern Pacific for the use of its Mojave division by the Atlantic & Pacific, the Atchison, Topeka & Santa Fé, and the St. Louis & San Francisco. A special master is appointed to determine the benefits derived by the roads from their use of the division.

Zanesville, Mt. Vernon & Marion.—The foreclosure sale of this property, including the Belt Line at Zanesville, O., connecting with the Zanesville Terminal, will take place at Columbus, O., on Dec. 4, in accordance with the decree of the United States Circuit Court, given on Aug. 20 last, in the suit brought by the Mercantile Trust Co., of New York.

TRAFFIC.

Traffic Notes.

The St. Louis, Iron Mountain & Southern is to put on a mail train between St. Louis and Texarkana, which will run through in about 18 hours, a little quicker than the fastest train now running, which leaves St. Louis in the evening. The new train starts from St. Louis at 3 a. m. The Great Northern has shortened the time of its through train between St. Paul and the Pacific Coast 4½ hours. The Chicago & Northwestern has re-arranged the schedule of its fast mail train to the West, and the time to points in Northern Nebraska, to Deadwood and other places in that region, will be 24 hours quicker than heretofore.

Through travel from New York to the South is now reported heavy. Mr. R. D. Carpenter, Eastern Passenger Agent of the Southern Railway, reports that extra sleeping cars have to be run on the through trains nearly every day.

The Chicago-Great Western gives notice that to meet the action of the Soo Line it will re-establish a city ticket office in the West Hotel, Minneapolis, Minn., which is likely to re-open the entire question of outside agencies in the Northwest.

The Missouri, Kansas & Texas, by the announcement that it proposes to run two additional harvest excursions to Texas points, is likely to precipitate trouble in that territory, the other lines looking upon it as a breach of faith.

A meeting is being held at St. Louis this week between Eastern and Western roads for the better arrangement of uniform divisions on through traffic.

Rates on live hogs and packing house products will be advanced 1½ cents per 100 lbs. from the Missouri River to Chicago as soon as the necessary tariffs can be prepared.

Central Traffic Association Meeting.

The Central Traffic roads held a meeting at Cleveland last week which may have more than usually good results as action was taken similar to that heretofore taken by the roads west of Chicago, looking to the more immediate control of traffic matters by the general managers or presidents. It was resolved that a central executive committee be constituted to consist of the following officers: W. J. Spicer, H. B. Ledyard, D. W. Caldwell, James McCrea, D. S. Gray, W. W. Peabody, M. E. Ingalls, G. L. Bradbury, W. M. Greene, Orland Smith, E. B. Thomas, J. G. Williams, C. M. Hays, S. R. Callaway. A chairman and vice-chairman will be elected from the above gentlemen. Twelve members will constitute a quorum, and the vote of nine shall govern. To this committee will be referred all disagreements of the Central Freight and Passenger Committees.

The "General Freight Committee" consists of 18 members and the Passenger Committee of 15. Commissioners Blanchard and Donald will be chairmen of these respectively.

President Ingalls, on being appealed to at the meeting to "pull up" the Chesapeake & Ohio, gave notice that hereafter the representative of the Cleveland, Cincinnati, Chicago & St. Louis would be authorized to represent the Chesapeake & Ohio. Heretofore whenever there have been charges against this road it has generally been the case that there was no representative present at the meeting.

Resolutions were adopted restricting the issuance of annual passes and pledging the members to issue no passes that will have the effect of influencing business. Action concurrent with that of the Western roads at St. Louis was taken respecting mileage on freight cars. It was voted to advance the eastbound grain rate to the basis of 25 cents per 100 lbs., Chicago to New York, effective Nov. 12, the present rate being 20 cents. Recommendations to the Joint Committee were made concerning joint agencies and commissions on passenger traffic. The work of the meeting will be reviewed by the trunk lines and the Joint Committee at New York, this week, at which confirmatory action is expected.

Meeting of Western and Southwestern Lines at St. Louis.

By a combination of blunders such as country newspapers ascribe to the office devil and metropolitan dailies to the office cat, the following article was left out last week; but as the action taken seems to have concerned more than the usual number of important matters, we publish it now as a matter of record.

The series of meetings held at St. Louis was concluded Oct. 19. A large amount of important business was transacted and considerable headway made in various directions looking to the better maintenance of rates in western, southwestern and southern territory.

At the meeting of the Executive Committee of the Western and Southwestern Roads the report of the Chairman of the Western Trunk Line Committee, submitting the result of previous meetings of his committee and recommendations as to percentages that should govern a physical division of east bound business through the lower Missouri River gateways was presented. The percentages submitted, including merchandise, grain, packing house product, live stock and dressed meats were unanimously adopted, and it was agreed to make them effective October 22. This completes the action of the western lines, with the exception of providing the working rules, which is to be done by the Trunk Line Committee. The agreement is now effective as to west bound business through all crossings from Kansas City to Omaha, inclusive, St. Paul, Minneapolis and Des Moines and Sioux City, and as to east bound tonnage, from all lower Missouri River crossings.

The question of mileage on freight cars was again taken up and a resolution passed to the effect that the rate of

mileage paid for freight cars shall not exceed six mills per car per mile run, loaded or empty, from and after Nov. 1, 1894. In case there are existing contracts at higher rates, those shall be reported to the Commissioner, and all lines shall be at liberty to meet the mileage rates enforced by such contracts. The committee was continued and was directed to devise methods for the practical adoption of the per diem system in connection with other committees from the lines in eastern and southern territory, as well as the American Railway Association. The committee was also instructed to report on the practicability of a speedy reduction of mileage on refrigerators.

The practical result of the resolution is the advancing of the mileage rate from 5 mills as agreed to by the western roads some months ago, to 6 mills a mile, in conformity with the compromise agreed upon at the conference of eastern and western lines recently held in New York City, with the exception of refrigerator and tank cars. As to refrigerator cars (which have never been included in the agreement) it was found that existing contracts stood in the way of an advance at present. An effort was made to induce the Standard Oil people to agree to a rate of 6 mills on tank cars, but without success, and as it was found that not only the Chicago Great Western, but some of the eastern lines as well had made contracts on the basis of 7½ mills for this class of cars, no further effort was made to reduce it at present. The Chicago Great Western and Soo Line were not represented, and the other lines, members of the original agreement, decided to go ahead regardless of these two roads.

The question of the issuance of free transportation for 1895 was then taken up and the agreement which was adopted in January last and which subsequently went to pieces was practically reaffirmed by the lines present. Thirty-six roads have assented and the agreement will become effective when the assent of competing lines not represented at the meeting is obtained. Chairman Midgley is confident that the agreement will be made and that this time it will stick. It was agreed that for the balance of the year no free transportation should be issued in the territory covered by the new southwestern agreement, just adopted, which should have the effect of influencing business, and that no transportation of this kind should be issued in any territory covered by the lines present bearing limit later than December 31 next.

Considerable progress was also made in the direction of a better maintenance of rates to southern points.

Chicago Traffic Matters.

CHICAGO, Oct. 31, 1894. Eastbound rail shipments last week showed a slight gain over the preceding week. Rates remain about the same, but Central Traffic officials predict a much better situation as likely to ensue now that matters are being again straightened out. Lake shipments also show a slight increase, notwithstanding the bottom has dropped out of grain rates owing to the small offerings. Iron ore shipments eastbound, and the anthracite coal westbound, continue heavy. Grain shipments from this port last week included 235,000 bushels wheat, 575,000 bushels corn, 199,023 bushels oats, 312,000 bushels barley, and 49,161 barrels flour. Grain rates dropped to ¼ cent a bushel on oats to Buffalo. Rates from Lake Superior ports, however, are being well maintained.

The Western roads have given up all attempts to secure the co-operation of the Canadian Pacific in their immigrant clearing house agreement, and have determined to take the necessary action to protect their own interests. A committee is now endeavoring to secure the co-operation of the Trunk Lines in meeting this competition. It is said that with the exception of the New York Central the Eastern lines are inclined to join in the proposed action. The Central is said to be enjoying very satisfactory traffic arrangements with the Canadian Pacific via Ogdensburg, which it is extremely averse to severing.

The light grain movement is distributing the customary movement of empty cars, the general merchandise movement westbound being in excess of the eastbound requirements some of the time.

Some of the Western roads are reporting a gratifying increase in tonnage. The Atchison, for example, reports that its equipment on some of its roads is being taxed to supply the present demand for cars.

The Eastern lines have finally decided to absorb the switching charge of \$2 a car on packing house products from the Union Stock Yards. The Chicago & Grand Trunk goes still further, and announces that it will reduce the switching charge on hogs to \$1 a car, and the other roads have been authorized to take similar action. A charge of \$1 a car on cattle remains, but it may be taken off soon. The live stock commission men are now after the Western roads to get them to rescind their action in adding the \$2 charge to billing, and they go so far as to threaten legal proceedings unless it is done.

It has been agreed among the interested lines that the Illinois Central may put in effect its proposed round-trip rate of \$100 from Chicago to California points via New Orleans as an experiment. If any of the other roads find that it is interfering with their revenues they can apply to the Western Passenger Association for a rehearing.

The Chicago & Alton announces a series of monthly excursions, seven in all, from Chicago and all points in Illinois, to points south of the Ohio River, extending in time from Nov. 13 to April 30, at one fare for the round trip. The Illinois Central and probably the Wabash and other lines will take similar action.

The shipments of eastbound freight, not including live stock from Chicago, by all the lines for the week ending Oct. 27, amounted to 47,526 tons, against 46,594 tons during the preceding week, an increase of 922 tons, and against 63,333 tons for the corresponding week last year. The proportions carried by each road were:

ROADS.	WEEK. TO OCT. 27.		WEEK. TO OCT. 20.	
	Tons.	p. c.	Tons.	p. c.
Michigan Central.....	3,191	6.7	2,516	5.4
Wabash.....	5,340	11.2	6,514	14.0
Lake Shore & Mich. South..	4,098	8.5	4,057	8.7
Pitts., Ft. Wayne & Chicago.	5,506	11.6	5,165	11.1
Pitts., Cin., Chi. & St. Louis	7,873	16.6	8,178	17.5
Baltimore & Ohio.....	3,376	7.1	4,194	8.9
Chicago & Grand Trunk....	3,707	7.8	3,446	7.4
New York, Chic. & St. Louis	7,044	14.8	6,236	13.4
Chicago & Erie.....	5,056	10.6	5,426	11.6
C., C. & St. Louis.....	2,385	5.1	862	1.2
Totals.....	47,526	100.0	46,594	100.0

Of the above shipments 1,595 tons were flour, 14,199 tons grain and mill stuff, 8,930 tons cured meats, 12,268 tons dressed beef, 1,405 tons butter, and 5,159 tons lumber. Lake lines carried 44,322 tons against 42,900 tons last week.